W. P. D. LOGAN

Mortality in England and Wales from 1848 to 1947

SYNOPSIS

This is a survey of the changing causes of death in England and Wales at different ages during the past 100 years. Based on the published mortality statistics of the General Register Office the framework of the survey is a series of specially prepared tables of death rates by sex, age and cause of death for the periods 1848-72, 1901-10, 1921, 1931, 1939, and 1947. Adjustments were made wherever necessary to compensate for changes in medical nomenclature and the statistical classification of disease.

After allowance has been made for the changing age structure of the population, the total male death rate at all ages in1947 was 42 per cent of the rate in 1846-50, and the female rate 35 per cent. Maximum improvement was among girls aged 5-9 years, whose death rate in 1947 was 9 per cent of the rate 100 years before.

In 1848-72 the group to which were allocated the largest proportion of the deaths at all ages were the infections diseases with one-third of the total; and these were followed by the respiratory, nervous, and digestive diseases. In 1947, on the other hand, diseases of the circulatory system came first with rather more than one-third of the total at all ages, and these were followed by cancer.

Changes in proportionate mortality rates from various causes have been examined at successive ages from infancy to old age. There was a decline in proportionate mortality from the infectious diseases other than tuberculosis, but increased mortality from tuberculosis in the younger age groups and from violence, circulatory diseases and cancer.

The trends of absolute mortality from the various causes were also studied. The reduction in total mortality was such that whereas there were half a million civilian deaths registered in England and Wales in 1947, the total would have been over a million had the death rates of 1848-72 still prevailed.

The thesis concludes with a brief review of the factors responsible for the changes that have taken place.

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Mortality in England and Wales from 1848 to 1947

BY W. P. D. LOGAN

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A survey of the changing causes of death during the past hundred years

By W. P. D. Logan

> 'How the people of England live is one of the most important questions that can be considered; and how—of what causes, and at what ages—they die is scarcely of less account; for it is the complement of the primary question teaching men how to live a longer, healthier and happier life.'
>
> Supplement to 35*th Annual Report of Registrar-General* (1875)

Although the published statistics of the General Register Office provide a series of annual death rates extending back into the first half of the nineteenth century, it is necessary to explain at the outset that the interpretation of these records, especially in connexion with particular causes of death, presents certain difficulties. Owing to changes of one kind and another during the course of the past hundred years, not only in the way in which the facts have been ascertained and presented, but in the meaning of many of the terms used to describe the causes of death, as much care is required to compare death rates *from a particular cause* in this country over a long period of time as to compare the contemporary records of different countries that perhaps vary in their methods of death registration, in the standards of medical skill whereby the causes of death are determined, and in the way in which their mortality statistics are published. Among the medical practitioners who certified the causes of death in 1848 were a few who had received their medical training towards the end of the eighteenth century, a hundred and fifty years earlier than some who commenced to practise in 1947.

Nowadays few, if any, deaths in England and Wales escape registration, and the cause of almost every registered death has been certified by a medical practitioner or a coroner. The terms appearing in the registers to state the cause of death have become more technical and more precise; there has been a great reduction in the use of vague and indefinite terms, old age, convulsions, dropsy, natural causes, and the like. The knowledge and the diagnostic skill of medical practitioners has continuously increased, assisted by the development of bacteriological, radiological and other means of medical investigation. Less and less often do doctors mention on death certificates only symptomatic or terminal conditions that fail to indicate the underlying disease that was the real cause of death; and with increasing knowledge new diseases are recognized and given new names.

Apart from this, however, there are continuously changing fashions in medical certification, so that it is often a difficult matter to decide whether an increase in the frequency with which a particular cause of death is certified reflects a real increase in the incidence of that condition or represents a new attitude in regard to its medical

certification. A typical example of this problem in recent years has arisen from the increasing number of deaths certified as due to disease of the coronary arteries.

With the advance of medical science have come changes in the statistical classification of disease. To the users of the official statistics these classificational changes sometimes cause a certain amount of difficulty. But these changes, troublesome though they may be, have been necessary in order that classification should keep pace with increasing knowledge of the aetiological and pathological nature of disease. Changes of classification in the Registrar General's mortality statistics took place in 1881 and 1901, and thereafter at approximately ten-year intervals. The effects of many of these changes are slight, and usually it is not a difficult matter to keep track of them and to make such adjustments as may be required.

A much more important change took place in 1940 when, along with the adoption of the Fifth Revision of the International List of Causes of Death, the system for selecting one cause for tabulation as the principal cause of death when more than one cause has been mentioned on the death certificate was altered. Prior to 1940 selection of the principal cause had been determined on the basis of certain rules whereby conditions of various types—violence, infectious diseases, malignant tumours and so on—were given an arbitrary order of precedence, no notice being taken of the order in which the certifying practitioner wrote down the various causes of death. In 1940 this system of selection according to rules was given up, and since then selection has been made in accordance with the practitioner's preference as indicated by the order of certification. Prior to introducing the new system in 1940 the Registrar General classified deaths by both methods for a number of years; this dual classification has provided a bridge from one system to the other and has prevented a complete break in the continuity of the records.

Although it is possible with a certain amount of industry to make adjustments that will compensate for changes of nomenclature and classification and for changes in the system of cause selection—and in the present study these adjustments have been made—it is a more difficult matter to know how much allowance to make for the less tangible but no less disturbing effects that have arisen from the changes in medical ideas and in fashions of certification mentioned previously, and in the ever-increasing accuracy of diagnosis. But though these effects cannot be removed by any statistical operation it must not be thought that their presence so distorts the mortality picture as to make a long-term study of the records altogether misleading or unprofitable. In the following pages will be described some of the most important changes in the pattern of mortality as revealed by the official records. Attention will be called to certain changes that are probably fictitious, but there can be no doubt that the majority of the changes to be described are to a great extent real.

Changes in death rates from all causes

Although this study will be concerned with particular causes or groups of causes of death, it will be advantageous, as a preliminary, to consider the changes in death rates at various ages from all causes combined. Section A of Table 1 shows these rates for males in twelve age groups from infancy to old age at quarter century intervals

Table 1. *Mean annual death rates per* 1000 *living and percent of* 1846–50, *by sex and age. Comparative mortality indices, infant mortality per* 1000 *live births, England and Wales,* 1846–50, 1871–75, 1896–1900, 1921–25, 1947

	All ages		Infant mortality per 1000 live births	Deaths per 1000 living											
	Deaths per 1000 living	C.M.I.		0–	5–	10–	15–	20–	25–	35–	45–	55–	65–	75–	85+
A. Males															
1846–1850	24·1	2·204	172	74	9·5	5·4	7·4	10	11	14	19	33	70	153	320
1871–1875	23·3	2·130	167	70	7·1	4·0	5·7	8·1	10	14	20	35	70	150	323
1896–1900	18·8	1·825	170	62	4·1	2·3	3·6	4·9	6·5	11	18	34	68	143	283
1921–1925	12·9	1·186	86	27	2·6	1·7	2·7	3·5	4·1	6·5	12	25	58	136	273
1947	13·5	0·921	46	14	1·0	0·8	1·6	2·1	2·1	3·4	9·0	23	53	126	267
B. Males															
1846–1850	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1871–1875	97	97	97	95	75	74	77	81	91	100	105	106	100	98	101
1896–1900	78	83	99	84	43	43	49	49	59	79	95	103	97	93	88
1921–1925	54	54	50	36	27	31	36	35	37	46	63	76	83	89	85
1947	56	42	27	19	11	15	22	21	19	24	47	70	76	82	83
C. Females															
1846–1850	22·6	2·534	142	64	9·2	5·7	8·1	9·6	11	14	17	30	63	140	298
1871–1875	20·7	2·321	138	60	6·6	4·0	5·9	7·4	9·2	12	16	29	61	135	294
1896–1900	16·6	1·951	141	53	4·2	2·4	3·4	4·1	5·6	9·1	14	27	59	127	259
1921–1925	11·4	1·255	66	22	2·4	1·7	2·6	3·1	3·6	5·0	8·8	19	46	113	241
1947	11·3	0·892	36	11	0·8	0·6	1·2	1·8	1·9	2·7	5·7	13	35	97	220
D. Females															
1846–1850	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
1871–1875	92	92	97	94	72	70	73	77	84	86	94	97	97	96	99
1896–1900	73	77	99	83	46	42	42	43	51	65	82	90	94	91	87
1921–1925	50	50	46	34	26	30	32	32	33	36	52	63	73	81	81
1947	50	35	25	17	9	11	15	19	17	19	34	43	56	69	74

from 1846–50 to 1947. In Section B the rates in successive periods are expressed as percentages of those in 1846–50. The crude rate for males of all ages, 24·1 per thousand in 1846–50, dropped successively to 23·3 in 1871–75, to 18·8 in 1896–1900, and to 12·9 in 1921–25. Subsequently there was a small increase to 13·5 in 1947 (excluding non-civilians), and the rate in 1947 was 56% of what it was a hundred years before. The increase between 1921–25 and 1947 was caused by the ageing of the population, and when allowance has been made for the increasing proportion of old people, as the Comparative Mortality Index (C.M.I.) does, it is seen that the death rate in 1947 was in fact much lower than in 1921–5, 42% of the 1846–50 rate compared with 54% in 1921–5. The male infant mortality rate was 172 per thousand live births in 1846–50, and up to the end of the century failed to record any improvement whatsoever. In the next 50 years it halved itself twice, so that the rate in 1947 was one-quarter of what it was both in 1896–1900 and in 1846–50. The decline in death rates at each age up to 40 was remarkably uniform, though the rates in 1947 at ages 15–24 are slightly inflated by reason of the exclusion of non-civilians. The age group showing the greatest decline was 5–9, where the rate in 1947 was 11% of that in 1846–50. Out of equal numbers of boys, for every nine who died each year in 1846–50 only one died in 1947. Improvement was much less in the oldest age groups; nevertheless, even among old men over 85 there was a substantial fall in mortality, 12% up to the turn of the century and altogether 17% by 1947.

Considerable as was the decline in male mortality it was exceeded at every age by female. The group aged 5–9 again showed the greatest reduction, to 9% of the original rate. At ages over 85 the death rate in 1947 was one-quarter less than 1846–50.

Fig. 1 illustrates these changes in mortality for both sexes and demonstrates an important feature about the age distribution of deaths in 1947, namely, the upthrust of mortality among young persons of both sexes at ages 15–24. This can be partly explained, as has been mentioned above, by the fact that non-civilians have been excluded from the 1947 rates; non-civilians, having been medically examined before entering the services, tend to be healthier than members of the civilian population of the same age. But this is not the whole explanation. There has been a tendency during the whole of these hundred years for the mortality curve to bulge up a little at these young adult ages. It will be shown in due course what particular causes have been responsible for these high rates at this period of life.

The causes of death by sex and age

Tables 2–9 present a series of death rates from selected causes and groups of causes. Each table is in four parts. Part A gives male death rates per million of the population at each age. Such rates can be called absolute death rates to distinguish them from those in Part B which are male death rates per thousand deaths from all causes at each age and can be called proportionate rates. Similarly, Part C and Part D of each table give absolute and proportionate death rates for females.

Both the selection of particular causes and groups of causes, and the selection of particular periods of time, were determined to some extent by expediency and depended largely upon the data available and the method of presentation at different

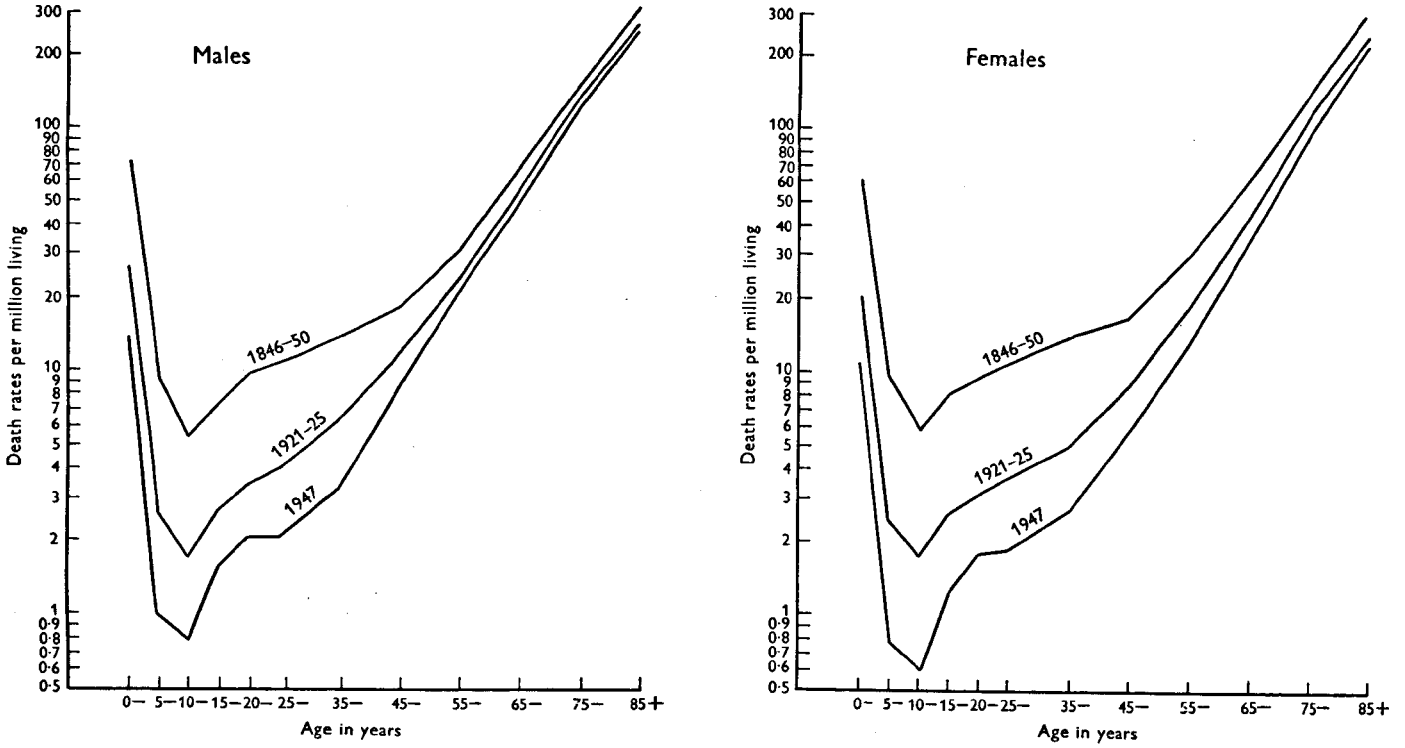


Fig. 1. Mean annual death rates at various ages per million living. England and Wales, 1846–50, 1921–25, 1947. Logarithmic scale.

periods. The object was to select particular diseases or disease groups which were likely to be important causes of death, which had not undergone such great classificational changes that they could not be followed through the records, which had not seriously changed their meaning or identity from the point of view of the certifying medical practitioners, and which appeared in the mortality tabulations by sex and age for the relevant time periods. All these desiderata could not be achieved, and the final selection of causes and years represents something of a compromise between what was wanted and what could be got. Nevertheless, it will be found that they serve their purpose well in illustrating the changing causes of mortality.

The time periods dealt with are 1848–72, 1901–10, 1921, 1931, 1939 and 1947. The first two periods were chosen because tabulations were available which gave deaths at ages with sufficient detail of cause that they could be readily linked up with later classifications. 1921 and 1931 were census years. In 1939 deaths were tabulated both by the Fourth and Fifth Revisions of the International List and by the old and the new system of selection from multiple causes. 1947 was the latest year for which detailed records were available at the time this study was undertaken. To achieve comparability between rates in 1947 and in the earlier periods adjusting factors were calculated for each cause at each age from the dual tabulation of 1939. These factors were applied to the published death rates for 1947 to obtain rates that would have been recorded in that year if the changes introduced in 1940 had not occurred. The method resembles that used by the Registrar General in the opposite direction to make rates for deaths at all ages between 1931 and 1939 comparable with those for more recent years. Age-specific rates for 1947 according to the method of cause selection in use in that year are shown in Appendix 1 and have been designated '1947 (Selection by certifying medical practitioner's preference)' to distinguish them from the adjusted rates used here in Tables 2–11 and designated '1947 (Selection by rules)'.

The choice of particular diseases and groups of diseases for inclusion in the tables depended, as has been said, upon the data available, and for convenience the same series of diseases was studied at each age despite the fact that a selection suitable for studying mortality among the young will not be found suitable for studying mortality among the old. It should be noted, too, that the list of causes in Tables 2–9 does not contain a residual category, viz. 'other causes'. Thus the main cause groups which are distinguished in the tables by being set out slightly to the left do not add up to the total from all causes. Similarly, the individual diseases that have been distinguished in the various groups because of their importance or interest do not in any instance comprise all the diseases constituting the group.

Cause of death at all ages

Table 2 presents absolute and proportionate death rates at all ages. This table will be discussed in some detail, despite the fact that the rates are *crude* rates, since it is the first of the main series of tables that constitute the framework of this study. Much that will be said about it will be applicable to the age-specific rates that follow later, and comment on these later tables can therefore be much briefer.

Table 2A. *All ages. Mean annual death rates per million living. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**23,448**	**16,373**	**12,946**	**13,033**	**12,950**	**13,550**
Infectious diseases	7,517	3,282	2,038	1,317	1,220	963
Typhoid and paratyphoid		109	17	7	3	1
Typhus	899	1	—	—	—	—
Smallpox	299	16	0·3	0·3	—	1
Measles	435	328	66	92	8	18
Scarlet fever	1,341	111	35	12	5	1
Whooping cough	471	255	113	58	29	21
Diphtheria		178	127	70	57	6
Influenza	68	216	249	360	219	98
Cholera	231	0·006	—	—	—	—
Dysentery	81	9	7	4	4	3
Respiratory tuberculosis	2,532	1,367	1,001	872	667	614
Other tuberculosis	900	535	264	169	111	85
Syphilis	63	58	57	50	44	29
Cancer	220	773	1,141	1,450	1,667	2,023
Diabetes mellitus	38	103	105	118	146	92
Anaemia	1	54	62	52	56	48
Diseases of the nervous system and sense organs	3,029	1,909	1,309	1,021	980	1,027
Cerebral haemorrhage, apoplexy, etc.	951	737	706	605	643	730
Diseases of the circulatory system	1,254	1,606	1,845	3,170	4,325	5,235
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	878	1,376	1,338	2,265	2,844	2,940
Diseases of the coronary arteries and angina pectoris		34	41	238	658	1,222
Diseases of the respiratory system	3,469	2,917	2,209	1,795	1,192	1,235
Bronchitis	1,557	1,176	928	653	430	473
Pneumonia (all forms)	1,325	1,467	1,103	989	635	623
Diseases of the digestive system	1,936	1,484	1,061	736	659	613
Ulcer of the stomach		37	56	106	129	105
Ulcer of the duodenum			31	62	65	80
Diarrhoea and enteritis	1,102	874	526	148	115	160
Appendicitis		68	81	84	73	40
Cirrhosis of the liver		129	71	55	39	26
Non-venereal diseases of the genito-urinary system and annexa	333	608	577	731	676	620
Nephritis	107	431	358	432	334	290
Suicide	63	158	153	189	168	137
Other violence	1,075	669	490	570	654	496
Accidental burns	143	64	38	31	26	15
Rail, road and air transport accidents		128	141	261	311	179

Table 2B. *All ages. Proportionate rates per* 1000 *deaths from all causes. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	321	200	157	101	94	71
Typhoid and paratyphoid		7	1	1	0·2	0·07
Typhus	38	0·1	—	—	—	—
Smallpox	13	1	0·02	0·02	—	0·04
Measles	19	20	5	7	0·6	1
Scarlet fever	57	7	3	1	0·4	0·07
Whooping cough	20	16	9	4	2	2
Diphtheria		11	10	5	4	0·4
Influenza	3	13	19	28	17	7
Cholera	10	0·000	—	—	—	—
Dysentery	3	1	1	0·3	0·3	0·2
Respiratory tuberculosis	108	83	77	67	51	45
Other tuberculosis	38	33	20	13	9	6
Syphilis	3	4	4	4	3	2
Cancer	9	47	88	111	129	149
Diabetes mellitus	2	6	8	9	11	7
Anaemia		3	5	4	4	4
Diseases of the nervous system and sense organs	129	117	101	78	76	76
Cerebral haemorrhage, apoplexy, etc.	41	45	55	46	50	54
Diseases of the circulatory system	53	98	143	243	334	386
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	37	84	103	174	220	217
Diseases of the coronary arteries and angina pectoris		2	3	18	51	90
Diseases of the respiratory system	148	178	171	138	92	91
Bronchitis	66	72	72	50	33	35
Pneumonia (all forms)	57	90	85	76	49	46
Diseases of the digestive system	83	91	82	56	51	45
Ulcer of the stomach		2	4	8	10	8
Ulcer of the duodenum			2	5	5	6
Diarrhoea and enteritis	47	53	41	11	9	12
Appendicitis		4	6	6	6	3
Cirrhosis of the liver		8	5	4	3	2
Non-venereal diseases of the genito-urinary system and annexa	14	37	45	56	52	46
Nephritis	5	26	28	33	26	21
Suicide	3	10	12	15	13	10
Other violence	46	41	38	44	50	37
Accidental burns	6	4	3	2	2	1
Rail, road and air transport accidents		8	11	20	24	13

Table 2C. All ages. Mean annual death rates per million living. Females

	1848–72	1901–10	1921	1931	1939	1947
All causes	**21,418**	**14,404**	**11,311**	**11,615**	**11,319**	**11,268**
Infectious diseases	7,232	2,703	1,695	1,470	895	652
Typhoid and paratyphoid		74	15	6	—	0·5
Typhus	888	1	—	—	3	—
Smallpox	242	10	—	0·2	—	0·2
Measles	403	290	53	73	7	14
Scarlet fever	1,236	101	34	14	5	1
Whooping cough	553	297	128	67	33	24
Diphtheria		178	125	64	49	6
Influenza	71	212	226	361	219	82
Cholera	218	—	—	—	—	—
Dysentery	68	7	7	2	2	2
Respiratory tuberculosis	2,629	968	776	622	420	371
Other tuberculosis	690	453	222	140	88	75
Syphilis	57	43	38	24	18	12
Cancer	481	1,027	1,279	1,516	1,677	1,815
Diabetes mellitus	18	90	110	170	220	157
Anaemia		65	83	71	83	71
Diseases of the nervous system and sense organs	2,502	1,702	1,234	1,002	1,012	1,140
Cerebral haemorrhage, apoplexy, etc.	925	825	784	706	757	907
Diseases of the circulatory system	1,351	1,578	1,754	3,109	3,995	4,436
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	881	1,443	1,432	2,464	2,957	2,974
Diseases of the coronary arteries and angina pectoris		16	17	99	303	555
Diseases of the respiratory system	2,864	2,409	1,720	1,422	858	765
Bronchitis	1,439	1,156	852	607	325	259
Pneumonia (all forms)	994	1,056	744	702	450	442
Diseases of the digestive system	1,817	1,304	815	560	467	411
Ulcer of the stomach		63	37	41	38	36
Ulcer of the duodenum			6	8	11	11
Diarrhoea and enteritis	991	713	382	114	89	113
Appendicitis		45	62	61	53	28
Cirrhosis of the liver		97	32	27	20	14
Non-venereal diseases of the genito-urinary system and annexa	132	435	377	450	373	305
Nephritis	69	347	288	376	302	245
Diseases of pregnancy, childbirth and the puerperal state	217	211	167	125	84	43
Puerperal sepsis	111	93	59	50	22	8
Suicide	22	49	50	73	81	78
Other violence	359	284	196	264	305	263
Accidental burns	132	83	45	38	34	25
Rail, road and air transport accidents		20	35	82	79	52

Table 2D. *All ages. Proportionate rates per 1000 deaths from all causes. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	338	188	150	127	79	58
Typhoid and paratyphoid		5	1	0·5	—	0·04
Typhus	41	0·05	—	—	0·2	—
Smallpox	11	1	—	0·02	—	0·02
Measles	19	20	5	6	1	1
Scarlet fever	58	7	3	1	0·5	0·1
Whooping cough	26	21	11	6	3	2
Diphtheria		12	11	6	4	0·5
Influenza	3	15	20	31	19	7
Cholera	10	—	—	—	—	—
Dysentery	3	0·5	1	0·2	0·2	0·1
Respiratory tuberculosis	123	67	69	54	37	33
Other tuberculosis	32	31	20	12	8	7
Syphilis	3	3	3	2	2	1
Cancer	22	71	113	130	148	161
Diabetes mellitus	1	6	10	15	19	14
Anaemia		5	7	6	7	6
Diseases of the nervous system and sense organs	117	118	109	86	89	101
Cerebral haemorrhage, apoplexy, etc.	43	57	69	61	67	80
Diseases of the circulatory system	63	110	155	268	353	394
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	41	100	127	212	261	264
Diseases of the coronary arteries and angina pectoris		1	2	9	27	49
Diseases of the respiratory system	134	167	152	122	76	68
Bronchitis	67	80	75	52	29	23
Pneumonia (all forms)	46	73	66	60	40	39
Diseases of the digestive system	85	91	72	48	41	36
Ulcer of the stomach		4	3	3	3	3
Ulcer of the duodenum			0·5	1	1	1
Diarrhoea and enteritis	46	49	34	10	8	10
Appendicitis		3	6	5	5	2
Cirrhosis of liver		7	3	2	2	1
Non-venereal diseases of the genito-urinary system and annexa	6	30	33	39	33	27
Nephritis	3	24	25	32	27	22
Diseases of pregnancy, childbirth and the puerperal state	10	15	15	11	7	4
Puerperal sepsis	5	6	5	4	2	1
Suicide	1	3	4	6	7	7
Other violence	17	20	17	23	27	23
Accidental burns	6	6	4	3	3	2
Rail, road and air transport accidents		1	3	7	7	5

Crude rates at all ages for different periods have to be viewed cautiously, since misleading trends may arise because of changes in the age structure of the population. When the population has been ageing, as in England and Wales, causes of death that operate especially among the elderly tend to become relatively more important. Hence the crude death rate from these causes, and perhaps also the total death rate from all causes, may rise. The difficulty can be overcome by using standardized death rates which make allowance for age changes in the population. Here, however, it has not been considered worth while to standardize the death rates because the death rates at different ages, which follow later, will provide much more information than would standardized rates.

Among the causes of death in 1848–72 by far the largest group was that of the infectious diseases with absolute rates of 7517 per million (male) and 7232 per million (female), the corresponding proportionate male and female rates being 321 and 338 per thousand deaths from all causes. Thus one death in every three was attributed to infectious disease. The highest individual cause of death within the groups was respiratory tuberculosis with absolute rates of 2532 per million (male) and 2629 per million (female), or 108 and 123 per thousand deaths from all causes, thus constituting roughly one-third of all deaths from infectious disease. To avoid frequent repetition of the phrases 'absolute rate per million of the population' and 'proportionate rate per thousand deaths from all causes' these will usually be expressed henceforth simply as 'per million' and 'per thousand'. The fundamental difference of meaning between the two sets of rates must not be forgotten. After respiratory tuberculosis the next highest cause of death within the group was scarlet fever, including diphtheria which was not distinguished in the records until 1855 and has not been shown here separately during the period 1848–72. The combined rates were 1341 per million (male) and 1236 per million (female), or 57 and 58 per thousand, approximately half as high as the respiratory tuberculosis rates. Of the combined deaths it can be estimated that at least two-thirds were due to scarlet fever and one-third to diphtheria (including croup). Typhus gave rates of 899 (male) and 888 (female) per million, 38 and 41 per thousand, but this included an unknown but large number of cases of typhoid. The two conditions were not distinguished in the records until 1869. The death rates from all forms of tuberculosis other than respiratory were 900 (male) and 690 (female) per million, or 38 and 32 per thousand. This group of tuberculous conditions comprises chiefly bone and joint tuberculosis, abdominal tuberculosis, and tuberculosis of the central nervous system. To it were assigned all deaths in 1848–72 described as from hydrocephalus, many of which probably were tuberculous meningitis. The rates from hydrocephalus were 438 (male) and 311 (female) per million, or 19 and 15 per thousand. Of the other infectious diseases attention may be drawn to the death rate from smallpox, 299 and 242 per million, 13 and 11 per thousand; whooping cough, 471 and 553 per million, 20 and 26 per thousand (note the higher rate among females than males); measles, 435 and 403 per million, 19 and 19 per thousand; and cholera, 231 and 218 per million, 10 and 10 per thousand. The period 1848–72 included the severe cholera epidemics of 1849, 1854 and 1866.

There has been a striking decline not only in the absolute death rate from the infectious diseases but also in their relative importance among all causes of death. The rates for the group had fallen to 3282 (male) and 2703 (female) per million, 200 and 188 per thousand, in 1901–10 and continued to fall to 963 and 652 per million, 71 and 58 per thousand in 1947. Thus compared with one death in three in 1848–72, the infectious diseases caused one male death in fourteen, and one female death in seventeen in 1947. All the individual infectious diseases except influenza contributed to this great reduction in mortality. Cholera and typhus disappeared, smallpox and typhoid just failed to do so. The reduction in mortality from scarlet fever, though obscured by its early confusion with diphtheria, has been enormous. It is well known that scarlet fever has become a mild disease compared with around 1870, but it is not always realized how very mild it has become. It caused less than one death in every 10,000 in 1947 compared with one in 140 in 1901–10 and perhaps one in 25 in 1848–72. Measles and whooping cough, too, have recorded very large declines. Because of epidemic fluctuations from year to year the rates, especially for measles, have tended to be erratic when single-year periods have been compared, but the general tendency is obvious. It is evident, too, that the decline in mortality began long before the introduction of sulphonamide and penicillin therapy, effective as these substances have been in preventing a number of deaths. In 1947 measles contributed one and whooping cough two deaths to every thousand total deaths compared with about twenty from each disease in 1848–72.

Compared with the foregoing the decline in tuberculosis has been less spectacular. It has, nevertheless, been considerable. Mortality from tuberculosis of the lungs declined from 2532 to 614 per million, 108 to 45 per thousand for males, and from 2629 to 371 per million, 123 to 33 per thousand for females. Non-respiratory tuberculosis fell from 900 to 85 per million, 38 to 6 per thousand for males and from 690 to 75 per million, 32 to 7 per thousand for females. The death rate from syphilis (which, in the classification used here, excludes locomotor ataxia, general paralysis of the insane, and aneurysm of the aorta) declined, for males, from 63 to 29 per million and, for females, from 57 to 12 per million. It is difficult to know how much reliance to place upon these figures since syphilis has never been fully reported at death certification, especially if the diagnosis was at all in doubt.

After the infectious diseases the next cause of death to be considered is cancer. From 220 (male) and 481 (female) per million, the rates rose progressively at each period and by 1947 were 2023 and 1815. Less than one male death in 100 was attributed to cancer in 1848–72, against one in seven in 1947. The female proportions were one in forty-five in 1848–72, one in six in 1947. Probably much of this apparent increase in cancer is fictitious. A part is attributable to the ageing of the population; but as the increase occurred at every age, as Tables 3–9 will show, ageing of the population is far from being the whole explanation. More complete certification by doctors, much more accurate diagnosis and perhaps less reluctance on the part of doctors to mention the condition, though this last is doubtful, have contributed to the apparent increase. There may have been a real increase in the incidence of cancer of certain sites. It is difficult to believe, for instance, that the very greatly increased reporting

of cancer of the lungs in recent years has been due entirely to more thorough medical investigation; cancer may have become more prevalent at that site.

Diabetes mellitus mortality among males rose from 38 per million in 1848–72 to 103 per million in 1901–10 (2 to 6 per thousand). Thereafter it rose more slowly to 146 per million (11 per thousand) in 1939. This increase, as later tables will show, took place only among elderly men; among boys and young adults the effect of insulin, introduced about 1923, was quite dramatic and brought about a rapid lowering of mortality. This is an example of the kind of differential age-trend that is liable to be missed when death rates at all ages are studied instead of age-specific rates. Among females the increase in mortality was rather greater, from 18 per million in 1848–72 to 220 per million in 1939 (1 to 19 per thousand). In both sexes there was a sudden reduction after 1939, one of the beneficial effects of war-time restrictions in food supplies.

Diseases of the nervous system caused death rates of 3029 per million (129 per thousand) for males in 1848–72, 2502 per million (117 per thousand) for females. These rates dropped to about 1000 per million in 1931, 1939 and 1947. At first only about one-third of these deaths were the result of intracranial vascular lesions (cerebral haemorrhage, thrombosis, embolism and so on), but by 1947 four-fifths of the deaths were assigned to these causes.

Comparable in magnitude with the increase in cancer has been the rise in mortality from diseases of the circulatory system which for males rose from 1254 to 5235 per million, 53 to 386 per thousand, and for females from 1351 to 4436 per million, 63 to 394 per thousand. Within this group is that perplexing problem of twentieth-century medicine, disease of the coronary arteries, the recorded mortality of which rose from 34 per million for males in 1901–10 to 1222 per million in 1947 and for females from 16 to 555 per million. In 1947 about one male death in ten and one female death in twenty was attributed to this disease that was practically unknown at the beginning of the century.

The mortality from diseases of the respiratory system, the two chief components of which are bronchitis and pneumonia, declined considerably up to 1939 but, except for pneumonia, rose again slightly between then and 1947. In view of the efficacy of the sulphonamides and penicillin in the treatment of pneumonia the smallness of the recent decline in the pneumonia death rate may perhaps be wondered at. Much of the mortality of pneumonia is, however, due to the broncho-pneumonia of infancy and old age, which has proved much less responsive to treatment than the lobar pneumonia of the middle years of life. Later tables will show that at these middle years the mortality from pneumonia has greatly diminished.

In 1848–72 diseases of the digestive system caused death rates of 1936 per million for males (83 per thousand) and 1817 per million for females (85 per thousand). By 1947 the rates had fallen to 613 per million (45 per thousand) and 411 per million (36 per thousand). Mortality from gastric ulcer in males was at its highest in 1939, but in females the rate in 1901–10 was higher than in any subsequent period. Among males the death rate from duodenal ulcer has increased steadily; it was

one-half that of gastric ulcer in 1939, three-quarters in 1947. Diarrhoea and enteritis constitute a group of diseases of fairly definite symptomatology but of multiple and often obscure aetiology. Some are due to gastro-intestinal infection, some are of dietetic origin, and in some the diarrhoea is no more than a prominent symptom of an undiagnosed underlying condition. In 1848–72 the rates were 1102 (male) and 991 (female) per million, compared with 115 and 89 per million in 1939. Rates in 1947 were higher than in 1939 and much the same as in 1931. In both sexes mortality from appendicitis halved between 1931 and 1947. Thanks to effective surgery it has never, since it was first distinguished, been a numerically important cause of death. The reduction since 1901–10 in mortality attributed to cirrhosis of the liver is partly due to a change of fashion in certification, partly to better diagnosis, but also contains a component reflecting the more abstemious habits of recent years.

Mortality from diseases of the genito-urinary system rose between 1848–72 and 1901–10 but changed little thereafter. The low rates in 1848–72 are to some extent the result of assigning all deaths from dropsy to the circulatory group; some of these were presumably of renal origin. The death rates from dropsy in 1848–72 were 345 and 459 per million, 15 and 21 per thousand.

Death rates from suicide in 1901–10 were more than double the rates in 1848–72. After 1901–10 the male rate rose to a maximum in 1931 and subsequently declined; the female rate, by contrast, was highest in 1939. It is not, however, very satisfactory to attempt to describe the trend of suicide mortality from the rates for isolated years. If the full series of annual rates were examined it would be noticed that they fell abruptly during the two world wars but were high during the period of economic depression around 1931.

The death rates from other forms of violence declined in both sexes between 1848–72 and 1901–10 but thereafter remained fairly steady. Although the risk of accident has increased, especially as a result of the growth of road traffic, the fatality of injuries has been reduced. The mortality of burns fell from 143 (male) and 132 (female) per million in 1848–72 to 15 and 25 per million in 1947. The death rates resulting from accidents associated with transport were 128 (male) and 20 (female) per million in 1901–10 and rose to 311 and 79 per million in 1939. The remission subsequent to 1939 is attributable to petrol restrictions which have prevented the return of road traffic to its 1939 level.

Death rates from maternal causes, viz. diseases of pregnancy, childbirth and the puerperal state, should properly be based upon numbers of maternities or, more usually, upon numbers of births, live and still. Here, however, to preserve uniformity, they are based on the female population and on all causes of death. The death rates in 1848–72 were 217 per million (10 per thousand), half being due to sepsis. Thereafter reduction was slow, and by 1931 the death rate had dropped only to 125 per million. The next 16 years up to 1947, however, saw a great acceleration of improvement and the rate in 1947 was 43 per million. The rate from puerperal sepsis, 50 per million in 1931, fell to 8 per million in 1947. Credit for this dramatic reduction in maternal mortality must be shared amongst the ante-natal services, improved

nutrition of expectant mothers, better obstetrical and post-natal care, and modern chemotherapy. 'It furnishes a notable example of what can be achieved by the concerted effort of medical specialists, biochemists, and public health workers when the national conscience has at last been aroused by the persistent presentation of unpleasant statistical facts' (*Registrar General's Statistical Review*, Medical Text, 1940–5).

The proportionate distribution of the leading groups of causes of death at all ages (and at separate ages) are summarized later in Table 10 and are illustrated in Fig. 2. The order of the four leading cause groups in 1848–72 was the same in both sexes, infectious, respiratory, nervous and digestive diseases. In 1947 the two leading causes were the circulatory diseases and cancer, followed by respiratory and nervous diseases in that order among males and in the opposite order among females.

Attention may be drawn at this stage to Appendix 2, which gives the leading groups of causes of death in 1947 in accordance with the system of selection and classification prevailing in that year (here designated 'selection by certifying medical practitioner's preference') without adjustment to achieve uniformity with earlier rates. Fig. 2 illustrates the rates for 1947 by both systems of selection, and shows to what extent the relative importance of the leading cause groups has been affected by the change. The chief effect at 'all ages' is to increase the importance of the respiratory and nervous diseases at the expense largely of the circulatory group, the order of the groups, however, remaining unchanged.

Discussion of the death rates at various ages, which now follows, will, as has been said above, be briefer than that of the 'all ages' rates. Moreover, since it is patently impossible to comment upon Tables 3–9 from all angles and to discuss all the tendencies that they reveal it is proposed to concentrate chiefly, though not exclusively, upon proportionate variations (Parts B and D of each table). Absolute trends will be summarized afterwards (Table 11 and Appendix 3).

Causes of death at ages under 1

The infant mortality rate, as usually defined, is the number of deaths of children aged under 1 year per thousand children born alive, the number of births constituting a more trustworthy denominator than the estimated population under 1. For uniformity with rates calculated for other ages, however, the infant death rates in Parts A and C of Table 3 are based on populations instead of births. Any inaccuracy so introduced is common to each of the listed causes of death and does not affect comparability between them.

Between 1848–72 and 1947 the male death rate under 1 year from all causes declined from 202,655 to 47,483 per million, and the female rate from 162,281 to 36,762 per million. With few exceptions each of the specified causes of death participated in this decline, notably the infectious diseases and diseases of the nervous system. The great reduction in convulsions is partly due to more precise certification, and partly due to better nutrition of infants. A phenomenon that is less easy to explain is the recent sharp increase in the mortality attributed to cerebral haemorrhage. Before going on to consider the proportionate rates it is worth observing how consistently male mortality has exceeded female from almost every cause. As has

frequently been noted, however, whooping cough is anomalous and causes more deaths among infant girls than boys. Why this should be no one so far has succeeded in explaining satisfactorily.

The proportionate distribution in 1848–72 of the main groups of causes was approximately as follows: In both sexes about one-fifth of all deaths were ascribed to the infectious diseases, the chief constituents of the group being non-respiratory tuberculosis and whooping cough. Diseases of the nervous system also accounted for one-fifth, mostly convulsions. Respiratory disease was responsible for about one-seventh, with the pneumonic mortality higher, but not much higher, than bronchitis. One-ninth were ascribed to digestive diseases, almost all being diarrhoeal. The classification that has been used here for other ages omits the most important group of causes of death in infancy, the so-called developmental and wasting diseases, including prematurity, congenital abnormalities, congenital debility, asphyxia, atelectasis and haemolytic disease of the new-born. This group, which has been included in Table 3, accounted for more than a quarter of the deaths, prematurity itself accounting for one-ninth.

Since 1848–72 the proportionate mortality from the infectious diseases has greatly diminished, and by 1947 caused only one death in twenty compared with the original proportion of one in five. The reduction in diseases of the nervous system was greater still—from one in five to one in thirty. By contrast the developmental and wasting group increased almost to half of the total (just over half for boys in 1939) and half of these, i.e. one-quarter of the total, were stated to be due only to prematurity. Other groups with rising proportions, but to a much less degree, were the respiratory and the digestive diseases. The respiratory diseases were highest proportionately in 1931 when they caused almost one-quarter of all deaths. The proportion assigned to bronchitis dropped sharply in 1939 and again in 1947, but pneumonia remained steady. Compared with the small pneumonia excess in 1848–72 (about 4 to 3) the ratio of pneumonia to bronchitis deaths in 1947 was about 9 to 1. This probably indicates no more than a change in the language of certification. Deaths that were at one time stated to be due to bronchitis would in more recent years be attributed to pneumonia.

Proportionate mortality from diseases of the digestive system was at its highest among males in 1921, among females in 1901–10. There was a rise between 1939 and 1947 associated with a recent increase in infantile gastro-enteritis, an increase that was absolute as well as proportionate.

Although the absolute death rate from violent causes almost halved between 1848–72 and 1947 this degree of improvement was less than for all causes combined. Accordingly, the proportionate death rates from violence increased, for males from 12 to 33 and for females from 14 to 36 per thousand.

The changes in the proportionate distribution of the leading causes of death under 1 year are summarized in Table 10 and Fig. 2. The order of leading causes was the same in both sexes. In 1848–72 the order was developmental and wasting diseases followed by nervous, infectious and respiratory diseases. In 1947 the developmental and wasting diseases increased their lead and, by both systems of selection, were followed in order by the respiratory, digestive and infectious diseases.

Table 3A. *Under 1 year. Mean annual death rates per million living. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**202,655**	**167,097**	**94,569**	**78,473**	**58,744**	**47,483**
Infectious diseases	36,103	19,295	8,213	7,156	3,245	2,289
Typhoid and paratyphoid		11	5	—	—	2
Typhus	1,010	—	—	—	—	—
Smallpox	2,035	49	—	3	—	—
Measles	2,877	3,249	658	1,284	161	322
Scarlet fever	4,056	206	66	32	10	4
Whooping cough	6,902	5,426	2,562	1,729	1,124	602
Diphtheria		400	272	168	95	25
Influenza	486	506	635	990	477	237
Cholera	693	—	—	—	—	—
Dysentery	643	42	12	13	16	25
Respiratory tuberculosis	2,254	507	143	148	95	143
Other tuberculosis	10,661	6,287	1,593	1,074	496	320
Syphilis	1,541	1,623	1,625	597	201	103
Cancer	20	34	35	58	36	34
Diabetes mellitus	1	2	—	6	—	—
Anaemia		89	28	42	53	4
Diseases of the nervous system and sense organs	42,636	20,571	7,262	3,783	2,620	1,374
Cerebral haemorrhage, apoplexy, etc.	562	44	26	—	3	58
Infantile convulsions	40,058	16,828	6,080	2,819	1,407	414
Diseases of the circulatory system	809	144	94	74	39	18
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	238	125	28	13	16	2
Diseases of the coronary arteries and angina pectoris)	—	—	—	—	—	—
Diseases of the respiratory system	30,446	29,724	17,319	18,351	10,237	8,783
Bronchitis	11,972	13,587	5,995	4,260	1,604	870
Pneumonia (all forms)	16,394	14,830	10,843	13,697	8,452	7,996
Diseases of the digestive system	23,554	30,714	18,803	7,989	6,078	6,740
Ulcer of the stomach		9	2	—	—	4
Ulcer of the duodenum			2	3	3	11
Diarrhoea and enteritis	20,677	26,418	16,185	6,415	4,987	5,841
Appendicitis		6	14	6	10	2
Cirrhosis of the liver		3	5	—	10	4
Non-venereal diseases of the genito-urinary system and annexa	90	329	258	229	302	199
Nephritis	32	259	101	58	76	56
Suicide	—	—	—	—	—	—
Other violence	2,419	2,901	1,009	1,261	1,354	1,588
Accidental burns	176	176	126	142	112	49
Rail, road and air transport accidents		13	7	6	10	4
Developmental and wasting diseases	53,895	56,383	37,522	34,537	29,247	21,501
Prematurity	22,687	26,397	21,698	21,266	17,446	11,074

Table 3B. *Under 1 year. Proportionate rates per 1000 deaths from all causes. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	1,000	1,000	1,000	1,000	1,000	1,000
Infectious diseases	178	115	87	91	55	48
Typhoid and paratyphoid		0·07	0·05	—	—	0·05
Typhus	5	—	—	—	—	—
Smallpox	10	0·3	—	0·04	—	—
Measles	14	19	7	16	3	7
Scarlet fever	20	1	1	0·4	0·2	0·1
Whooping cough	34	32	27	22	19	13
Diphtheria		2	3	2	2	1
Influenza	2	3	7	13	8	5
Cholera	3	—	—	—	—	—
Dysentery	3	0·3	0·1	0·2	0·3	1
Respiratory tuberculosis	11	3	2	2	2	3
Other tuberculosis	53	38	17	14	8	7
Syphilis	8	10	17	8	3	2
Cancer	0·1	0·2	0·4	1	1	1
Diabetes mellitus	0·007	0·01	—	0·08	—	—
Anaemia		1	0·3	1	1	0·09
Diseases of the nervous system and sense organs	210	123	77	48	45	29
Cerebral haemorrhage, apoplexy, etc.	3	0·3	0·3	—	0·06	1
Infantile convulsions	198	101	64	36	24	9
Diseases of the circulatory system	4	1	1	1	1	0·4
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	1	1	0·3	0·2	0·3	0·05
Diseases of the coronary arteries and angina pectoris	—	—	—	—	—	—
Diseases of the respiratory system	150	178	183	234	174	185
Bronchitis	59	81	63	54	27	18
Pneumonia (all forms)	81	89	115	175	144	168
Diseases of the digestive system	116	184	199	102	103	142
Ulcer of the stomach		0·05	0·03	—	—	0·09
Ulcer of the duodenum			0·03	0·04	0·06	0·2
Diarrhoea and enteritis	102	158	171	82	85	123
Appendicitis		0·04	0·1	0·08	0·2	0·05
Cirrhosis of the liver		0·02	0·1	—	0·2	0·09
Non-venereal diseases of the genito-urinary system and annexa	0·4	2	3	3	5	4
Nephritis	0·2	2	1	1	1	1
Suicide	—	—	—	—	—	—
Other violence	12	17	11	16	23	33
Accidental burns	1	1	1	2	2	1
Rail, road and air transport accidents		0·08	0·07	0·08	0·2	0·09
Developmental and wasting diseases	266	337	397	440	498	453
Prematurity	112	158	229	271	297	233

Table 3C. *Under 1 year. Mean annual death rates per million living. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**162,281**	**132,998**	**72,147**	**58,577**	**45,663**	**36,762**
Infectious diseases	31,289	17,351	7,348	6,298	2,887	2,052
Typhoid and paratyphoid		8	—	—	3	—
Typhus	841	—	—	—	—	—
Smallpox	1,859	59	—	10	—	—
Measles	2,421	2,767	592	1,071	137	266
Scarlet fever	3,178	172	41	43	10	2
Whooping cough	7,489	6,083	2,882	1,966	1,272	739
Diphtheria		327	200	163	75	21
Influenza	384	366	406	685	285	200
Cholera	562	—	—	—	—	—
Dysentery	450	33	17	7	10	12
Respiratory tuberculosis	1,979	424	157	136	51	108
Other tuberculosis	8,045	4,941	1,220	815	425	219
Syphilis	1,319	1,324	1,256	456	199	108
Cancer	23	25	19	33	58	47
Diabetes mellitus	2	1	—	—	—	2
Anaemia	—	65	43	27	41	31
Diseases of the nervous system and sense organs	31,762	15,385	5,128	2,615	1,882	1,033
Cerebral haemorrhage, apoplexy, etc.	417	32	12	3	—	33
Infantile convulsions	29,897	12,579	4,169	1,790	953	273
Diseases of the circulatory system	690	110	56	60	34	26
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	196	91	39	20	7	9
Diseases of the coronary arteries and angina pectoris	—	0·3	—	—	—	—
Diseases of the respiratory system	22,832	22,880	13,227	13,630	8,015	6,934
Bronchitis	9,192	10,650	4,778	3,274	1,416	711
Pneumonia (all forms)	12,121	11,222	8,143	10,164	6,479	6,228
Diseases of the digestive system	18,990	24,907	13,350	5,273	4,282	4,920
Ulcer of the stomach		6	—	—	—	5
Ulcer of the duodenum			2	—	—	—
Diarrhoea and enteritis	17,171	21,745	11,580	4,308	3,641	4,304
Appendicitis		5	5	—	10	2
Cirrhosis of the liver		5	5	—	—	—
Non-venereal diseases of the genito-urinary system and annexa	54	225	138	150	185	106
Nephritis	21	191	85	30	48	33
Suicide	—	—	—	—	—	—
Other violence	2,195	2,732	877	1,211	1,124	1,334
Accidental burns	174	168	80	93	117	47
Rail, road and air transport accidents		9	5	7	17	12
Developmental and wasting diseases	43,720	44,086	28,983	26,063	23,449	16,965
Prematurity	17,843	20,861	17,261	16,538	14,179	8,791

Table 3D. *Under 1 year. Proportionate rates per 1000 deaths from all causes. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	1,000	1,000	1,000	1,000	1,000	1,000
Infectious diseases	193	130	102	108	63	56
Typhoid and paratyphoid		0·06	—	—	0·08	—
Typhus	5	—	—	—	—	—
Smallpox	11	0·4	—	0·2	—	—
Measles	15	21	8	18	3	7
Scarlet fever	20	1	0·6	0·7	0·2	0·06
Whooping cough	46	46	40	34	28	20
Diphtheria		2	3	3	2	1
Influenza	2	3	6	12	6	5
Cholera	3	—	—	—	—	—
Dysentery	3	0·3	0·2	0·1	0·2	0·3
Respiratory tuberculosis	12	3	2	2	1	3
Other tuberculosis	50	37	17	14	9	6
Syphilis	8	10	17	8	4	3
Cancer	0·1	0·2	0·3	1	1	1
Diabetes mellitus	0·01	0·01	—	—	—	0·06
Anaemia	—	0·5	0·6	0·5	1	1
Diseases of the nervous system and sense organs	196	116	71	45	41	28
Cerebral haemorrhage, apoplexy, etc.	3	0·2	0·2	0·06	—	1
Infantile convulsions	184	95	58	31	21	7
Diseases of the circulatory system	4	0·8	0·8	1	1	1
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	1	0·7	0·5	0·3	0·2	0·3
Diseases of the coronary arteries and angina pectoris	—	0·002	—	—	—	—
Diseases of the respiratory system	141	172	183	233	176	189
Bronchitis	57	80	66	56	31	19
Pneumonia (all forms)	75	84	113	174	142	169
Diseases of the digestive system	117	187	185	90	94	134
Ulcer of the stomach		0·04	—	—	—	0·1
Ulcer of the duodenum			0·03	—	—	—
Diarrhoea and enteritis	106	163	161	74	80	117
Appendicitis		0·04	0·07	—	0·2	0·06
Cirrhosis of the liver		0·04	0·07	—	—	—
Non-venereal diseases of the genito-urinary system and annexa	0·3	2	2	3	4	3
Nephritis	0·1	1	1	1	1	1
Suicide	—	—	—	—	—	—
Other violence	14	21	12	21	25	36
Accidental burns	1	1	1	2	3	1
Rail, road and air transport accidents		0·07	0·07	0·1	0·4	0·3
Developmental and wasting diseases	269	331	402	445	514	461
Prematurity	110	157	239	282	311	239

Causes of death at ages 1–4

The total death rate for boys aged 1–4 (Table 4) was 36,383 per million in 1848–72 and 2384 per million in 1947. The corresponding rates for girls were 35,457 and 1956 per million. The death rates from infectious disease fell from almost 20,000 to under 800 per million, and the death rates from respiratory disease from about 6000 to between 400 and 500 per million.

Not every cause of death showed declining rates throughout the period. Reported deaths from cancer increased progressively with improving diagnosis. Fatal transport accidents attained their highest absolute level in 1931, declining both in 1939 and in 1947.

More than half of the total deaths in 1848–72 resulted from infectious disease; the proportionate rates were 544 per thousand male deaths and 557 per thousand female. These rates fell until 1921 when the infectious diseases were responsible for one death in every three, and since then there has been little change. At each period the female proportionate rate was higher than the male; by contrast the absolute rates showed a small but consistent male excess. Among the individual infectious diseases the most important by far in 1848–72 was scarlet fever (including diphtheria), to which was ascribed one death in every five from all causes. Next for boys came non-respiratory tuberculosis, 93 per thousand, measles, 80 per thousand, and whooping cough, 63 per thousand. Among girls whooping cough gave a rate of 88 per thousand, measles 82 per thousand, and non-respiratory tuberculosis 79 per thousand. Passing on to 1947 the most important of the infectious diseases in both sexes was non-respiratory tuberculosis, 124 (male) and 132 (female) per thousand. Next for males came measles, 53 per thousand, and whooping cough, 41 per thousand. Among females the order of these two was reversed—whooping cough, 77 per thousand, and measles, 63 per thousand. The enormous absolute reduction in mortality from these infections should be noted. Thus for boys the death rate from non-respiratory tuberculosis declined from 3391 to 295, from measles 2924 to 127, and from whooping cough 2304 to 99 per million, the rates for girls showing changes of about the same amount.

In 1848–72 diseases of the nervous system accounted for 85 per thousand male, 81 per thousand female deaths, and of these two-thirds were ascribed to convulsions. By 1947 the proportion of deaths from nervous diseases was 64 and 63 per thousand, with convulsions constituting only a small fraction.

The proportion of deaths attributed to diseases of the respiratory system has always been almost the same in both sexes, and rose from one-sixth in 1848–72 to one-fifth in 1947. During the intermediate years, however, the proportion was much higher, one-quarter in 1901–10 and 1939, and one-third in 1921 and 1931. The absolute death rate from pneumonia in 1939 was only one-third of what it was in 1931, and by 1947 it had halved again.

The decline in mortality from digestive diseases was much the same as from all causes, so that the proportionate rates changed little. Within the group diarrhoea and enteritis accounted for five-sixths of the deaths in 1848–72 but only a half in 1947.

In 1848–72 the death rates from violence were 33 and 24 per thousand. Despite considerable reduction in absolute mortality, the proportionate rates increased to 151 and 117 per thousand in 1947.

Summarizing the changes in proportionate distribution, the order of the leading causes, for both sexes, in 1848–72 was infectious, respiratory, nervous and digestive diseases. In 1947, by both systems of selection of causes, the order was infectious, respiratory, violence and digestive diseases (see Table 10 and Fig. 2).

Causes of death at ages 5–14

In 1848–72 the death rates from all causes were 6683 (male) and 6587 (female) per million (Table 5) and the male/female ratio was 1·01. In 1947 the rates were 913 and 683 per million, with a sex ratio of 1·34, the considerable male excess being attributable to higher mortality from violence.

In 1848–72 the infectious diseases were responsible for two-thirds of the total deaths occurring within the age group. The decline in absolute mortality was enormous—from 4128 (male) and 4545 (female) in 1848–72 to 220 and 222 per million in 1947, finally constituting only one-quarter of the total male, and one-third of the total female mortality.

The principal individual infectious diseases in 1848–72 were scarlet fever (including diphtheria), 243 (male) and 257 (female) per thousand; typhus (including typhoid), 117 and 140 per thousand; respiratory tuberculosis, 88 and 128 per thousand; and other, i.e. non-respiratory tuberculosis, 76 and 64 per thousand. One in every thirty deaths was due to smallpox, one in every fifty to cholera. The order of relative importance of the principal infectious diseases was the same for both sexes.

In 1947 the leading constituent of the infectious disease group was non-respiratory tuberculosis, 104 and 137 per thousand, or roughly one male death in ten and one female death in seven. Next came respiratory tuberculosis, with a marked sex difference; male rates 22 per million, 24 per thousand, and female rates 44 per million, 65 per thousand. After tuberculosis came diphtheria, 22 and 26 per thousand. The reduction in the absolute mortality from diphtheria between 1939 and 1947 bears striking testimony to the efficacy of immunization when carried out on a national scale. Between 1939 and 1947 the rate among boys fell from 206 to 20, and among girls from 195 to 18 per million. The virtual elimination of scarlet fever from the killing diseases is something else to be grateful for, though this has come about not so much as the result of human intervention, as from a loss of virulence on the part of the causative organism. Some day scarlet fever may try to regain its former reputation as a disease to be reckoned with.

Among boys deaths from violence (which throughout this study excludes suicide) occupied second place to the infectious diseases up to 1939, but in 1947 moved into first place and caused exactly one death in every three. Among girls, on the other hand, violent deaths failed to attain first place, and, in fact, did not get into second place until 1939. They caused one death in every six in 1947. Both among boys and girls transport accidents were the cause of one-quarter of violent deaths in 1901–10, but by 1939 and 1947 the proportion had increased to a half.

Table 4A. 1–4 *years. Mean annual death rates per million living. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	36,383	18,896	10,895	8,032	3,719	2,384
Infectious diseases	19,807	8,064	3,814	3,189	1,270	788
Typhoid and paratyphoid		37	5	—	—	1
Typhus	1,360	0·4	—	—	—	—
Smallpox	783	13	1	—	—	—
Measles	2,924	2,548	651	976	74	127
Scarlet fever	7,409	687	207	70	35	4
Whooping cough	2,304	1,305	707	445	179	99
Diphtheria		1,110	759	458	364	35
Influenza	69	93	211	237	79	29
Cholera	314	—	—	—	—	—
Dysentery	135	5	5	5	4	7
Respiratory tuberculosis	903	310	161	100	47	65
Other tuberculosis	3,391	1,845	942	625	385	295
Syphilis	33	30	25	12	4	—
Cancer	17	36	30	36	44	63
Diabetes mellitus	3	5	8	6	3	4
Anaemia		33	12	12	10	4
Diseases of the nervous system and sense organs	3,079	1,506	792	383	253	152
Cerebral haemorrhage, apoplexy, etc.	173	11	10	2	—	9
Infantile convulsions	2,052	524	338	95	43	13
Diseases of the circulatory system	291	66	53	39	26	7
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	78	63	42	34	20	4
Diseases of the coronary arteries and angina pectoris		—	—	—	—	—
Diseases of the respiratory system	6,262	5,258	3,693	2,782	938	487
Bronchitis	2,187	1,291	637	285	105	63
Pneumonia (all forms)	3,549	3,509	2,850	2,395	777	392
Diseases of the digestive system	2,309	1,852	1,348	570	367	220
Ulcer of the stomach		2	1	—	—	—
Ulcer of the duodenum			—	—	—	1
Diarrhoea and enteritis	2,013	1,496	1,041	276	151	109
Appendicitis		25	45	68	65	43
Cirrhosis of the liver		2	2	—	—	—
Non-venereal diseases of the genito-urinary system and annexa	91	128	78	61	42	36
Nephritis	51	118	71	42	31	20
Suicide	—	—	—	—	—	—
Other violence	1,193	787	605	564	513	361
Accidental burns	684	435	306	216	190	56
Rail, road and air transport accidents		86	112	199	153	130

Table 4B. 1–4 *years. Proportionate rates per* 1000 *deaths from all causes. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	544	427	350	397	341	331
Typhoid and paratyphoid		2	0·4	—	—	0·3
Typhus	37	0·02	—	—	—	—
Smallpox	22	1	0·07	—	—	—
Measles	80	135	60	121	20	53
Scarlet fever	204	36	19	9	10	2
Whooping cough	63	69	65	55	48	41
Diphtheria		59	70	57	98	15
Influenza	2	5	19	29	21	12
Cholera	9	—	—	—	—	—
Dysentery	4	0·3	0·4	1	1	3
Respiratory tuberculosis	25	16	15	12	13	27
Other tuberculosis	93	98	86	78	104	124
Syphilis	1	2	2	1	1	—
Cancer	0·5	2	3	4	12	—
Diabetes mellitus	0·08	0·3	1	1	1	27
Anaemia		2	1	2	3	2
Diseases of the nervous system and sense organs	85	80	73	48	68	64
Cerebral haemorrhage, apoplexy, etc.	5	1	1	0·2	—	4
Infantile convulsions	56	28	31	12	12	5
Diseases of the circulatory system	8	3	5	5	7	3
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	2	3	4	4	5	2
Diseases of the coronary arteries and angina pectoris		—	—	—	—	—
Diseases of the respiratory system	172	278	339	346	252	204
Bronchitis	60	68	59	35	28	27
Pneumonia (all forms)	98	186	262	298	209	165
Diseases of the digestive system	63	98	124	71	99	92
Ulcer of the stomach		·09	0·07	—	—	—
Ulcer of the duodenum			—	—	—	0·3
Diarrhoea and enteritis	55	79	96	34	41	46
Appendicitis		1	4	8	17	18
Cirrhosis of the liver		0·1	0·1	—	—	—
Non-venereal diseases of the genito-urinary system and annexa	3	7	7	8	11	15
Nephritis	1	6	7	5	8	8
Suicide	—	—	—	—	—	—
Other violence	33	42	55	70	138	151
Accidental burns	19	23	28	27	51	23
Rail, road and air transport accidents		5	10	25	41	55

Table 4C. 1–4 *years. Mean annual death rates per million living. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**35,457**	**17,975**	**9,990**	**7,028**	**3,260**	**1,956**
Infectious diseases	19,761	8,155	3,804	3,048	1,262	762
Typhoid and paratyphoid		36	2	3	1	—
Typhus	1,450	0·3	—	—	—	—
Smallpox	795	14	—	—	—	—
Measles	2,903	2,439	554	870	69	122
Scarlet fever	7,072	653	190	96	33	8
Whooping cough	3,107	1,792	1,003	636	281	151
Diphtheria		1,104	798	398	328	33
Influenza	68	82	166	211	67	32
Cholera	280	—	—	—	—	—
Dysentery	114	4	3	3	4	—
Respiratory tuberculosis	919	272	127	80	39	60
Other tuberculosis	2,797	1,649	815	531	335	259
Syphilis	38	30	24	13	3	—
Cancer	17	30	30	34	39	50
Diabetes mellitus	2	6	6	3	8	2
Anaemia		28	14	6	5	5
Diseases of the nervous system and sense organs	2,864	1,341	717	311	200	122
Cerebral haemorrhage, apoplexy, etc.	148	11	10	—	4	2
Infantile convulsions	1,975	490	303	79	40	19
Diseases of the circulatory system	250	63	49	25	18	9
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	71	60	43	17	12	6
Diseases of the coronary arteries and angina pectoris		—	—	—	—	—
Diseases of the respiratory system	6,065	4,878	3,282	2,367	852	398
Bronchitis	2,149	1,265	608	235	111	50
Pneumonia (all forms)	3,437	3,210	2,511	2,056	690	329
Diseases of the digestive system	2,284	1,723	1,190	490	281	136
Ulcer of the stomach		2	—	1	—	—
Ulcer of the duodenum			—	—	—	—
Diarrhoea and enteritis	2,009	1,409	938	267	140	64
Appendicitis		18	38	50	41	28
Cirrhosis of the liver		2	3	2	—	—
Non-venereal diseases of the genito-urinary system and annexa	56	115	57	60	37	19
Nephritis	35	104	52	37	28	15
Suicide	—	—	—	—	—	—
Other violence	855	620	429	383	326	229
Accidental burns	551	406	250	175	142	62
Rail, road and air transport accidents		60	74	126	84	76

Table 4D. 1–4 *years. Proportionate rates per* 1000 *deaths from all causes. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	1,000	1,000	1,000	1,000	1,000	1,000
Infectious diseases	557	454	381	434	387	390
Typhoid and paratyphoid		2	0·2	0·4	0·3	—
Typhus	41	0·02	—	—	—	—
Smallpox	22	0·8	—	—	—	—
Measles	82	136	55	124	21	63
Scarlet fever	199	36	19	14	10	4
Whooping cough	88	100	100	90	86	77
Diphtheria		61	80	57	101	17
Influenza	2	5	17	30	20	16
Cholera	8	—	—	—	—	—
Dysentery	3	0·2	0·3	0·5	1	—
Respiratory tuberculosis	26	15	13	11	12	30
Other tuberculosis	79	92	82	75	103	132
Syphilis	1	2	2	2	1	—
Cancer	0·5	2	3	5	12	25
Diabetes mellitus	0·06	0·3	1	0·5	2	1
Anaemia		2	1	1	2	3
Diseases of the nervous system and sense organs	81	75	72	44	61	63
Cerebral haemorrhage, apoplexy, etc.	4	1	1	—	1	0·8
Infantile convulsions	56	27	30	11	12	10
Diseases of the circulatory system	7	4	5	4	6	4
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	2	3	4	2	4	3
Diseases of the coronary arteries and angina pectoris		—	—	—	—	—
Diseases of the respiratory system	171	271	328	337	261	204
Bronchitis	61	70	61	33	34	25
Pneumonia (all forms)	97	179	251	293	212	168
Diseases of the digestive system	64	96	119	70	86	70
Ulcer of the stomach		0·1	—	0·1	—	—
Ulcer of the duodenum			—	—	—	—
Diarrhoea and enteritis	57	78	94	38	43	33
Appendicitis	—	1	4	7	13	14
Cirrhosis of the liver	—	0·1	0·3	0·2	—	—
Non-venereal diseases of the genito-urinary system and annexa	2	6	6	9	11	10
Nephritis	1	6	5	5	9	8
Suicide	—	—	—	—	—	—
Other violence	24	34	43	54	100	117
Accidental burns	16	23	25	25	44	32
Rail, road and air transport accidents		3	7	18	26	39

Table 5A. 5–14 *years. Mean annual death rates per million living. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**6,683**	**2,796**	**2,276**	**1,881**	**1,357**	**913**
Infectious diseases	4,128	1,263	907	677	433	220
Typhoid and paratyphoid		61	9	4	1	—
Typhus	780	0·4	—	—	—	—
Smallpox	221	7	1	—	—	0·4
Measles	141	87	20	54	8	9
Scarlet fever	1,622	170	72	26	10	2
Whooping cough	70	29	13	12	4	1
Diphtheria		295	310	196	206	20
Influenza	10	26	46	45	17	5
Cholera	130	—	—	—	—	—
Dysentery	16	0·5	2	1	1	0·4
Respiratory tuberculosis	585	154	101	65	26	22
Other tuberculosis	509	398	275	181	114	95
Syphilis	1	2	1	4	2	1
Cancer	9	18	15	17	20	30
Diabetes mellitus	7	14	16	15	12	6
Anaemia		12	6	5	4	4
Diseases of the nervous system and sense organs	481	259	194	145	96	57
Cerebral haemorrhage, apoplexy, etc.	61	6	6	1	2	4
Diseases of the circulatory system	242	157	132	103	80	31
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	154	155	130	100	76	30
Diseases of the coronary arteries and angina pectoris		0·03	—	—	—	—
Diseases of the respiratory system	396	319	264	214	92	48
Bronchitis	99	33	22	18	12	7
Pneumonia (all forms)	210	222	207	169	67	34
Diseases of the digestive system	283	214	238	177	120	68
Ulcer of the stomach		2	—	1	—	—
Ulcer of the duodenum			0·3	0·3	—	—
Diarrhoea and enteritis	133	41	49	15	13	4
Appendicitis		89	105	82	59	37
Cirrhosis of the liver		2	1	1	2	1
Non-venereal diseases of the genito-urinary system and annexa	54	62	49	38	30	26
Nephritis	30	57	43	35	26	20
Suicide	1	2	2	0·3	1	1
Other violence	689	294	280	296	312	304
Accidental burns	103	32	17	12	8	8
Rail, road and air transport accidents		71	120	186	168	141

Table 5B. 5–14 *years. Proportionate rates per* 1000 *deaths from all causes. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	618	452	399	360	319	241
Typhoid and paratyphoid		22	4	2	1	—
Typhus	117	0·2	—	—	—	—
Smallpox	33	2	0·2	—	—	0·4
Measles	21	31	9	29	6	10
Scarlet fever	243	61	32	14	7	2
Whooping cough	11	11	6	6	3	1
Diphtheria		106	136	104	152	22
Influenza	1	9	20	24	12	5
Cholera	19	—	—	—	—	—
Dysentery	2	0·2	1	0·5	0·5	0·4
Respiratory tuberculosis	88	55	45	35	19	24
Other tuberculosis	76	142	121	96	84	104
Syphilis	0·1	1	0·2	2	1	1
Cancer	1	6	7	9	15	32
Diabetes mellitus	1	5	7	8	9	6
Anaemia		4	3	3	3	4
Diseases of the nervous system and sense organs	72	93	85	77	71	62
Cerebral haemorrhage, apoplexy, etc.	9	2	2	0·3	1	5
Diseases of the circulatory system	36	56	58	55	59	34
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	23	55	57	53	56	33
Diseases of the coronary arteries and angina pectoris)		0·01	—	—	—	—
Diseases of the respiratory system	59	114	116	114	68	52
Bronchitis	15	12	10	10	9	8
Pneumonia (all forms)	31	79	91	90	49	37
Diseases of the digestive system	42	77	105	94	89	74
Ulcer of the stomach		1	—	1	—	—
Ulcer of the duodenum			0·1	0·2	—	—
Diarrhoea and enteritis	20	15	22	8	10	4
Appendicitis		32	46	44	43	41
Cirrhosis of the liver		1	0·5	1	1	1
Non-venereal diseases of the genito-urinary system and annexa	8	22	21	20	22	28
Nephritis	4	20	19	19	19	22
Suicide	0·2	1	1	0·2	0·5	2
Other violence	103	105	123	157	230	333
Accidental burns	15	12	7	7	6	9
Rail, road and air transport accidents		25	53	99	124	154

Table 5C. 5–14 *years. Mean annual death rates per million living. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**6,587**	**2,907**	**2,256**	**1,734**	**1,137**	**683**
Infectious diseases	4,545	1,511	1,083	722	439	222
Typhoid and paratyphoid		69	11	3	1	—
Typhus	924	0·3	—	—	—	—
Smallpox	207	7	—	0·3	—	—
Measles	158	101	29	45	10	10
Scarlet fever	1,691	174	85	34	13	4
Whooping cough	111	48	21	15	8	7
Diphtheria		355	351	214	195	18
Influenza	11	29	53	46	19	7
Cholera	120	—	—	—	—	—
Dysentery	13	1	1	1	0·3	0·4
Respiratory tuberculosis	844	292	231	113	56	44
Other tuberculosis	419	411	252	175	106	94
Syphilis	1	2	4	4	1	1
Cancer	8	14	11	11	16	17
Diabetes mellitus	6	15	21	15	14	4
Anaemia		10	8	4	7	7
Diseases of the nervous system and sense organs	446	257	180	127	83	47
Cerebral haemorrhage, apoplexy, etc.	55	7	3	1	2	1
Diseases of the circulatory system	246	208	171	129	79	30
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	174	205	167	126	77	29
Diseases of the coronary arteries and angina pectoris		0·3	—	—	—	—
Diseases of the respiratory system	411	310	245	209	94	54
Bronchitis	108	37	23	18	12	12
Pneumonia (all forms)	217	218	185	171	70	32
Diseases of the digestive system	267	203	222	167	109	56
Ulcer of the stomach		5	3	1	0·3	0·4
Ulcer of the duodenum			0·3	—	—	—
Diarrhoea and enteritis	133	49	44	19	11	3
Appendicitis		63	90	59	47	31
Cirrhosis of the liver		2	2	2	2	1
Non-venereal diseases of the genito-urinary system and annexa	31	56	46	41	30	24
Nephritis	21	52	41	37	25	20
Diseases of pregnancy, childbirth and the puerperal state	0·05	0·09	0·3	—	—	—
Puerperal sepsis	0·02	0·03	—	—	—	—
Suicide	1	1	—	0·3	0·3	—
Other violence	266	154	119	144	121	115
Accidental burns	172	94	43	23	25	17
Rail, road and air transport accidents		18	45	91	64	58

Table 5 D. 5–14 *years. Proportionate rates per* 1000 *deaths from all causes. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	690	520	480	417	386	325
Typhoid and paratyphoid		24	5	2	1	—
Typhus	140	0·1	—	—	—	—
Smallpox	31	2	—	0·2	—	—
Measles	24	35	13	26	9	14
Scarlet fever	257	60	38	20	11	6
Whooping cough	17	17	9	9	7	10
Diphtheria		122	156	123	171	26
Influenza	2	10	24	27	17	10
Cholera	18	—	—	—	—	—
Dysentery	2	0·2	0·2	0·4	0·3	1
Respiratory tuberculosis	128	101	102	65	49	65
Other tuberculosis	64	141	112	101	93	137
Syphilis	0·1	1	2	2	1	1
Cancer	1	5	5	6	14	26
Diabetes mellitus	1	5	9	9	13	6
Anaemia		4	4	2	6	10
Diseases of the nervous system and sense organs	68	89	80	73	73	69
Cerebral haemorrhage, apoplexy, etc.	8	2	1	0·4	2	2
Diseases of the circulatory system	37	71	76	74	·70	44
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	26	71	74	72	68	43
Diseases of the coronary arteries and angina pectoris		0·1	—	—	—	—
Diseases of the respiratory system	62	107	109	121	82	79
Bronchitis	16	13	10	10	10	18
Pneumonia (all forms)	33	75	82	99	61	46
Diseases of the digestive system	41	70	98	97	96	82
Ulcer of the stomach		2	1	0·4	0·3	1
Ulcer of the duodenum			0·1	—	—	—
Diarrhoea and enteritis	20	17	20	·11	9	5
Appendicitis		22	40	34	41	45
Cirrhosis of the liver		1	1	1	2	2
Non-venereal diseases of the genito-urinary system and annexa	5	19	21	24	27	36
Nephritis	3	18	18	21	22	30
Diseases of pregnancy, childbirth and the puerperal state	0·008	0·03	0·1	—	—	—
Puerperal sepsis	0·003	0·01	—	—	—	—
Suicide	0·1	0·5	—	0·2	0·3	—
Other violence	40	53	53	83	106	169
Accidental burns	26	32	19	13	22	25
Rail, road and air transport accidents		6	20	52	57	85

Diseases of the nervous system had rates of 72 and 68 per thousand in 1848–72. These proportions remained practically unchanged throughout and in 1947 were 62 and 69. The proportionate rates from respiratory diseases rose to a maximum during the middle years, and digestive and circulatory diseases showed a similar tendency.

For boys the order of principal causes in 1848–72 was infectious, violence, nervous and respiratory diseases, and in 1947 (selection by rules) violence, infectious, digestive and nervous diseases. For girls, however, the order in 1848–72 was infectious, nervous, respiratory and digestive diseases and in 1947 infectious, violence, digestive and respiratory diseases (Table 10 and Fig. 2), the order of the digestive and respiratory diseases among girls being reversed when selection was based on the certifying medical practitioner's preference.

Causes of death at ages 15–24

Deaths rates in 1848–72 from all causes combined were 7578 (male) and 7817 (female) per million (Table 6). In 1947 the rates were 1834 and 1527 per million. There has thus been a reversal of the sex ratio from a female to a male excess. Death rates from the infectious diseases were 4688 and 5297 per million in 1848–72, 645 and 894 per million in 1947. The proportionate rate for young men declined from 619 to 351 per thousand, while the rate for young women managed only to fall from 678 to 586. It will be seen that the high rates from infectious disease at these ages, especially among women, were due to respiratory tuberculosis which here completely dominates the list of causes of death.

In 1848–72 two-thirds of the male deaths from infectious disease, or two-fifths of all deaths, were attributed to respiratory tuberculosis; in 1947 the proportion has dropped to a quarter of all deaths. The female proportionate rate, on the other hand, did not decline; it was 479 per thousand in 1848–72 and was 478 in 1947. What this means, of course, is that the absolute death rate from respiratory tuberculosis in young women had fallen to exactly the same degree as the death rate from all causes. It does not mean that there was no reduction in mortality from respiratory tuberculosis among young women.

Second in importance among young men, but much lower in the scale for young women, was the mortality from violent causes (excluding suicide); the male rates were 118 per thousand in 1848–72, 236 in 1947, with transport accidents latterly contributing half of the total deaths from violence.

In each sex diseases of the nervous, circulatory, respiratory and digestive systems gave rates in 1848–72 of from 40 to 60 per thousand and, apart from a tendency for the proportion of deaths from circulatory disease to increase, showed little change in 1947.

Maternal causes contributed 30 per thousand in 1848–72 and 43 per thousand in 1947. The absolute rate, however, dropped from 233 to 65 per million. Up to 1931 about half of all maternal deaths resulted from sepsis. By 1947, with chemotherapy firmly established, the proportion of maternal deaths ascribed to sepsis was only one in six.

To summarize, the principal groups of causes of death at 15–24 were: for males

in 1848–72, infectious, violence, respiratory and nervous diseases, and in 1947 infectious, violence, circulatory and nervous diseases; and for females in 1848–72, infectious, nervous, circulatory and digestive diseases, and in 1947, infectious, circulatory, nervous and maternal diseases (Table 10 and Fig. 2), the order of the two last groups being reversed under selection by the certifying medical practitioner's preference. By far the greatest constituent of the infectious disease group was respiratory tuberculosis, and this was the outstanding cause of death at these ages.

Causes of death at ages 25–44

Total death rates in 1848–72 were 11,415 (male) and 10,891 (female) per million (Table 7). In 1947 the rates were 2801 and 2345 per million.

As in the previous age group mortality is here dominated by one disease, respiratory tuberculosis, which constituted almost the whole of the infectious disease group. In both sexes it caused one-third of all deaths in 1848–72 and one-quarter in 1947; but the absolute rates fell from 4088 and 4241 to 673 and 578 per million.

In this age group the death rates from cancer call for mention; at younger ages mortality from cancer was negligible. The rates were 10 (male) and 33 (female) per thousand in 1848–72 rising with an even progression up to 125 and 180 per thousand in 1947. Much of this has been the result of better diagnosis, and perhaps practically the whole of the increase can be explained in this way.

Diseases of the circulatory system rose from 73 and 78 per thousand to 156 and 136. Relatively and absolutely more important among men than among women male deaths from coronary disease and angina pectoris rose from 1 per thousand in 1901–10 to 48 per thousand in 1947; the absolute male rates were 9 per million in 1901–10 rising to 133 per million in 1947, the latter rate being six times the corresponding rate for women.

Deaths from violence (other than suicide) were much higher among men than women, and the rates rose from 92 and 12 per thousand in 1848–72 to 122 and 27 per thousand in 1947. The proportion of fatal transport accidents increased progressively up to 1939 with a remission in 1947. The proportion of deaths by suicide increased in both sexes, and since 1921 more women at these ages have died from suicide than from all other violent causes.

In both sexes the proportion of deaths from respiratory diseases dropped considerably, especially among men. The proportionate rates from pneumonia in 1947, 32 (male) and 24 (female) per thousand, were one-third of the 1921 level; the absolute rates dropped from 558 and 272 per million in 1921 to 90 and 57 in 1947.

Digestive diseases caused death rates that fluctuated between 40 and 80 per thousand. The mortality from genito-urinary diseases maintained a constant proportion from 1901–10 onwards, about 40 (male) and 50 (female) per thousand. In men almost all deaths in this group were attributed to nephritis, in women about two-thirds. Maternal causes accounted for one death in twenty in 1848–72, one in ten in 1901–10 and 1921, and one in twenty in 1947. The proportion due to sepsis fell from a half of all maternal deaths in 1848–72 to one-fifth in 1947.

Table 6A. 15–24 *years. Mean annual death rates per million living. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**7,578**	**3,609**	**3,175**	**2,873**	**2,213**	**1,834**
Infectious diseases	4,688	1,670	1,459	1,224	775	645
Typhoid and paratyphoid		157	26	9	3	1
Typhus	839	1	—	—	—	—
Smallpox	222	9	—	—	—	—
Measles	8	3	1	2	—	—
Scarlet fever	152	26	15	7	4	0·5
Whooping cough	1	0·3	1	—	1	—
Diphtheria		16	18	13	11	2
Influenza	9	61	101	96	41	18
Cholera	102	—	—	—	—	—
Dysentery	20	2	3	1	1	1
Respiratory tuberculosis	3,064	1,120	1,008	820	541	471
Other tuberculosis	217	233	224	162	123	94
Syphilis	13	6	5	6	3	1
Cancer	22	41	40	46	53	68
Diabetes mellitus	23	41	42	22	17	10
Anaemia		16	8	6	7	6
Diseases of the nervous system and sense organs	405	247	215	158	140	125
Cerebral haemorrhage, apoplexy, etc.	101	19	15	3	4	9
Diseases of the circulatory system	332	267	262	191	148	138
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	265	261	257	183	135	118
Diseases of the coronary arteries and angina pectoris		1	—	—	1	2
Diseases of the respiratory system	415	366	302	242	136	89
Bronchitis	82	22	26	23	29	17
Pneumonia (all forms)	218	308	245	185	83	54
Diseases of the digestive system	316	208	202	151	135	83
Ulcer of the stomach		14	13	13	9	5
Ulcer of the duodenum			7	7	9	6
Diarrhoea and enteritis	108	28	12	8	10	7
Appendicitis		93	105	70	64	35
Cirrhosis of the liver		3	1	2	1	—
Non-venereal diseases of the genito-urinary system and annexa	80	87	68	78	77	57
Nephritis	43	79	58	67	64	56
Suicide	26	62	42	62	58	52
Other violence	891	436	381	534	525	432
Accidental burns	61	10	9	10	10	3
Rail, road and air transport accidents		101	114	337	331	213

Table 6B. 15–24 *years. Proportionate rates per* 1000 *deaths from all causes. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	619	463	459	426	350	351
Typhoid and paratyphoid		43	8	3	1	1
Typhus	111	0·2	—	—	—	—
Smallpox	29	2	—	—	—	—
Measles	1	1	0·2	1	—	—
Scarlet fever	20	7	5	2	2	0·3
Whooping cough	0·1	0·07	0·2	—	0·3	—
Diphtheria		4	6	4	5	1
Influenza	1	17	32	33	19	10
Cholera	13	—	—	—	—	—
Dysentery	3	0·7	1	0·4	0·4	1
Respiratory tuberculosis	404	310	318	285	245	257
Other tuberculosis	29	65	71	56	56	51
Syphilis	2	2	2	2	1	1
Cancer	3	11	13	16	24	37
Diabetes mellitus	3	11	13	7	8	5
Anaemia		4	2	2	3	3
Diseases of the nervous system and sense organs	53	68	68	55	63	68
Cerebral haemorrhage, apoplexy, etc.	13	5	5	1	2	5
Diseases of the circulatory system	44	74	83	67	67	75
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	35	72	81	64	61	64
Diseases of the coronary arteries and angina pectoris		0·2	—	—	0·4	1
Diseases of the respiratory system	55	101	95	84	61	49
Bronchitis	11	6	8	8	13	9
Pneumonia (all forms)	29	85	77	64	38	29
Diseases of the digestive system	42	58	63	53	61	45
Ulcer of the stomach		4	4	5	4	3
Ulcer of the duodenum			2	2	4	3
Diarrhoea and enteritis	14	8	4	3	5	4
Appendicitis		26	33	25	29	19
Cirrhosis of the liver		1	0·3	1	0·3	—
Non-venereal diseases of the genito-urinary system and annexa	11	24	21	27	35	31
Nephritis	6	22	18	23	29	30
Suicide	3	17	13	22	26	29
Other violence	118	121	120	186	237	236
Accidental burns	8	3	3	3	5	2
Rail, road and air transport accidents		28	36	117	150	116

Table 6C. 15–24 *years. Mean annual death rates per million living. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**7,817**	**3,195**	**2,960**	**2,662**	**1,924**	**1,527**
Infectious diseases	5,297	1,556	1,672	1,427	972	894
Typhoid and paratyphoid		99	24	7	3	1
Typhus	872	1	—	—	—	—
Smallpox	150	6	—	—	—	—
Measles	11	4	1	2	—	2
Scarlet fever	167	21	15	10	5	1
Whooping cough	2	1	1	—	—	—
Diphtheria		15	20	11	14	2
Influenza	9	46	85	81	34	12
Cholera	97	—	—	—	—	—
Dysentery	15	1	2	1	0·3	0·3
Respiratory tuberculosis	3,741	1,112	1,274	1,108	772	729
Other tuberculosis	175	226	201	147	113	109
Syphilis	21	5	5	7	5	2
Cancer	25	33	30	36	38	41
Diabetes mellitus	13	31	37	26	19	10
Anaemia		30	18	9	10	5
Diseases of the nervous system and sense organs	413	209	168	109	98	71
Cerebral haemorrhage, apoplexy, etc.	109	20	13	3	3	5
Diseases of the circulatory system	374	289	244	247	188	108
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	289	279	239	245	177	98
Diseases of the coronary arteries and angina pectoris		1	0·3	—	1	1
Diseases of the respiratory system	360	227	175	166	102	59
Bronchitis	87	20	13	22	15	8
Pneumonia (all forms)	169	180	141	120	70	34
Diseases of the digestive system	374	235	134	108	90	51
Ulcer of the stomach		91	13	5	2	2
Ulcer of the duodenum			1	1	1	1
Diarrhoea and enteritis	123	27	12	11	15	9
Appendicitis		53	62	40	38	14
Cirrhosis of the liver		2	1	0·3	—	—
Non-venereal diseases of the genito-urinary system and annexa	57	103	81	87	67	58
Nephritis	34	81	60	70	54	49
Diseases of pregnancy, childbirth and the puerperal state	233	216	169	144	92	65
Puerperal sepsis	167	112	68	67	24	10
Suicide	19	40	31	38	24	22
Other violence	120	67	64	109	104	63
Accidental burns	33	22	17	19	13	3
Rail, road and air transport accidents		7	13	59	63	32

Table 6D. 15–24 *years. Proportionate rates per* 1000 *deaths from all causes. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	678	487	565	536	505	586
Typhoid and paratyphoid		31	8	2	2	0·4
Typhus	112	0·2	—	—	—	—
Smallpox	19	2	—	—	—	—
Measles	1	1	0·5	1	—	2
Scarlet fever	21	7	5	4	3	1
Whooping cough	0·2	0·2	0·3	—	—	—
Diphtheria		5	7	4	7	2
Influenza	1	15	29	30	17	8
Cholera	12	—	—	—	—	—
Dysentery	2	0·3	1	0·4	0·2	0·2
Respiratory tuberculosis	479	348	430	416	401	478
Other tuberculosis	22	71	68	55	59	72
Syphilis	3	1	2	2	2	2
Cancer	3	10	10	13	20	27
Diabetes mellitus	2	10	12	10	10	7
Anaemia		10	6	3	5	4
Diseases of the nervous system and sense organs	53	65	57	41	51	47
Cerebral haemorrhage, apoplexy, etc.	14	6	4	1	2	3
Diseases of the circulatory system	48	90	82	93	98	71
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	37	87	81	92	92	64
Diseases of the coronary arteries and angina pectoris		0·3	0·1	—	1	1
Diseases of the respiratory system	46	71	59	62	53	39
Bronchitis	11	6	4	8	8	6
Pneumonia (all forms)	22	56	47	45	37	22
Diseases of the digestive system	48	73	45	41	47	33
Ulcer of the stomach		29	4	2	1	1
Ulcer of the duodenum			0·3	0·3	0·5	0·4
Diarrhoea and enteritis	16	9	4	4	8	6
Appendicitis		17	21	15	20	9
Cirrhosis of the liver		1	0·4	0·1	—	—
Non-venereal diseases of the genito-urinary system and annexa	7	32	27	33	35	38
Nephritis	4	25	20	26	28	32
Diseases of pregnancy, childbirth and the puerperal state	30	68	57	54	48	43
Puerperal sepsis	21	35	23	25	13	7
Suicide	2	12	10	14	13	14
Other violence	15	21	22	41	54	41
Accidental burns	4	7	6	7	7	2
Rail, road and air transport accidents		2	4	22	33	21

Table 7A. 25–44 *years. Mean annual death rates per million living. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	11,415	7,161	5,341	4,562	3,516	2,801
Infectious diseases	5,559	2,795	1,973	1,657	1,044	796
Typhoid and paratyphoid		162	21	8	4	1
Typhus	711	2	—	—	—	—
Smallpox	185	20	—	—	—	—
Measles	4	2	0·4	1	0·2	0·2
Scarlet fever	59	8	5	4	2	0·2
Whooping cough	0·4	0·2	—	—	—	—
Diphtheria		7	5	4	3	1
Influenza	15	130	172	193	81	22
Cholera	217	0·02	—	—	—	—
Dysentery	44	10	10	3	3	3
Respiratory tuberculosis	4,088	2,180	1,540	1,232	816	673
Other tuberculosis	132	185	125	99	73	52
Syphilis	29	28	23	26	14	6
Cancer	118	244	252	258	287	350
Diabetes mellitus	46	68	66	34	27	17
Anaemia		38	32	17	14	7
Diseases of the nervous system and sense organs	937	608	424	293	224	180
Cerebral haemorrhage, apoplexy, etc.	458	137	84	45	46	45
Diseases of the circulatory system	837	698	623	455	428	436
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	638	610	568	390	314	250
Diseases of the coronary arteries and angina pectoris		9	7	32	68	133
Diseases of the respiratory system	1,166	954	764	557	293	185
Bronchitis	383	117	124	91	58	48
Pneumonia (all forms)	462	722	558	400	182	90
Diseases of the digestive system	725	374	308	336	275	172
Ulcer of the stomach		41	66	87	77	39
Ulcer of the duodenum			37	55	40	42
Diarrhoea and enteritis	141	61	25	13	19	12
Appendicitis		56	57	58	47	23
Cirrhosis of the liver		84	26	14	11	8
Non-venereal diseases of the genito-urinary system and annexa	226	288	207	163	141	106
Nephritis	121	253	172	132	114	92
Suicide	79	197	147	161	135	100
Other violence	1,050	585	376	453	489	342
Accidental burns	65	16	7	14	9	4
Rail, road and air transport accidents		136	116	224	258	145

Table 7B. 25–44 *years. Proportionate rates per* 1000 *deaths from all causes. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	1,000	1,000	1,000	1,000	1,000	1,000
Infectious diseases	487	390	369	363	297	284
Typhoid and paratyphoid		23	4	2	1	0·4
Typhus	62	0·3	—	—	—	—
Smallpox	16	3	—	—	—	—
Measles	0·4	0·2	0·07	0·1	0·05	0·06
Scarlet fever	5	1	1	1	1	0·06
Whooping cough	0·03	0·03	—	—	—	—
Diphtheria		1	1	1	1	0·3
Influenza	1	18	32	42	23	8
Cholera	19	0·003	—	—	—	—
Dysentery	4	1	2	1	1	1
Respiratory tuberculosis	358	304	288	270	232	240
Other tuberculosis	12	26	23	22	21	18
Syphilis	3	4	4	6	4	2
Cancer	10	34	47	57	82	125
Diabetes mellitus	4	9	12	7	8	6
Anaemia		5	6	4	4	3
Diseases of the nervous system and sense organs	82	85	79	64	64	64
Cerebral haemorrhage, apoplexy, etc.	40	19	16	10	13	16
Diseases of the circulatory system	73	98	117	100	122	156
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	56	85	106	85	89	89
Diseases of the coronary arteries and angina pectoris		1	1	7	19	48
Diseases of the respiratory system	102	133	143	122	83	66
Bronchitis	34	16	23	20	16	17
Pneumonia (all forms)	40	101	104	88	52	32
Diseases of the digestive system	63	52	58	74	78	62
Ulcer of the stomach		6	12	19	22	14
Ulcer of the duodenum			7	12	11	15
Diarrhoea and enteritis	12	9	5	3	6	4
Appendicitis		8	11	13	13	8
Cirrhosis of the liver		12	5	3	3	3
Non-venereal diseases of the genito-urinary system and annexa	20	40	39	36	40	38
Nephritis	11	35	32	29	33	33
Suicide	7	27	28	35	38	36
Other violence	92	82	70	99	139	122
Accidental burns	6	2	1	3	2	1
Rail, road and air transport accidents		19	22	49	73	52

Table 7C. *25–44 years. Mean annual death rates per million living. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**10,891**	**5,959**	**4,413**	**3,835**	**2,966**	**2,345**
Infectious diseases	5,538	1,960	1,462	1,216	789	687
Typhoid and paratyphoid		92	19	6	3	0·1
Typhus	640	1	—	—	—	—
Smallpox	104	11	—	—	—	0·1
Measles	7	3	1	1	0·3	0·1
Scarlet fever	72	10	9	3	1	0·1
Whooping cough	0·5	0·3	—	—	0·1	0·1
Diphtheria		8	7	6	4	1
Influenza	15	97	133	148	73	15
Cholera	220	—	—	—	—	—
Dysentery	33	5	4	2	1	1
Respiratory tuberculosis	4,241	1,508	1,111	897	603	578
Other tuberculosis	111	169	121	85	57	49
Syphilis	32	19	14	13	12	5
Cancer	359	465	448	425	421	421
Diabetes mellitus	23	56	59	37	29	18
Anaemia		62	62	33	26	12
Diseases of the nervous system and sense organs	690	453	295	216	185	168
Cerebral haemorrhage, apoplexy, etc.	329	143	83	48	50	41
Diseases of the circulatory system	846	674	476	481	438	325
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	610	636	448	451	388	265
Diseases of the coronary arteries and angina pectoris		4	2	7	16	22
Diseases of the respiratory system	793	560	384	306	177	123
Bronchitis	321	106	64	38	28	26
Pneumonia (all forms)	249	389	272	228	116	57
Diseases of the digestive system	812	400	247	205	169	95
Ulcer of the stomach		85	39	21	12	6
Ulcer of the duodenum			6	5	4	3
Diarrhoea and enteritis	201	58	35	25	25	17
Appendicitis		38	50	39	32	13
Cirrhosis of the liver		72	14	9	5	6
Non-venereal diseases of the genito-urinary system and annexa	137	345	243	193	158	121
Nephritis	79	246	143	133	114	85
Diseases of pregnancy, childbirth and the puerperal state	624	569	448	327	222	113
Puerperal sepsis	290	240	154	129	59	21
Suicide	27	66	57	85	86	72
Other violence	127	96	72	80	84	62
Accidental burns	24	19	11	10	10	3
Rail, road and air transport accidents		9	16	34	36	24

Table 7D. 25–44 *years. Proportionate rates per* 1000 *deaths from all causes. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	509	329	331	317	266	293
Typhoid and paratyphoid		15	4	1	1	0·1
Typhus	59	0·2	—	—	—	—
Smallpox	10	2	—	—	—	0·06
Measles	1	1	0·2	0·3	0·1	0·06
Scarlet fever	7	2	2	1	0·4	0·06
Whooping cough	0·04	0·05	—	—	0·05	0·06
Diphtheria		1	1	2	1	0·4
Influenza	1	16	30	39	25	6
Cholera	20	—	—	—	—	—
Dysentery	3	0·8	1	0·5	0·4	0·3
Respiratory tuberculosis	389	253	252	234	203	247
Other tuberculosis	10	28	27	22	19	21
Syphilis	3	3	3	3	4	2
Cancer	33	78	101	111	142	180
Diabetes mellitus	2	9	13	10	10	8
Anaemia		10	14	9	9	5
Diseases of the nervous system and sense organs	63	76	67	56	62	72
Cerebral haemorrhage, apoplexy, etc.	30	24	19	13	17	17
Diseases of the circulatory system	78	113	108	125	148	138
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	56	107	101	118	131	113
Diseases of the coronary arteries and angina pectoris		1	0·3	2	6	10
Diseases of the respiratory system	73	94	87	80	60	53
Bronchitis	29	18	14	10	10	11
Pneumonia (all forms)	23	65	62	59	39	24
Diseases of the digestive system	75	67	56	54	57	41
Ulcer of the stomach		14	9	6	4	3
Ulcer of the duodenum			1	1	1	1
Diarrhoea and enteritis	18	10	8	7	8	7
Appendicitis		6	11	10	11	5
Cirrhosis of the liver		12	3	2	2	3
Non-venereal diseases of the genito-urinary system and annexa	13	58	55	50	53	51
Nephritis	7	41	32	35	38	36
Diseases of pregnancy, childbirth and the puerperal state	57	95	102	85	75	48
Puerperal sepsis	27	40	35	34	20	9
Suicide	2	11	13	22	29	31
Other violence	12	16	16	21	28	27
Accidental burns	2	3	2	3	3	1
Rail, road and air transport accidents		1	4	9	12	10

Summarizing the leading causes, these were for males in 1848–72 infectious, respiratory, violence, excluding suicide, and nervous diseases, and in 1947 infectious and circulatory diseases, cancer and violence. For females the order in 1848–72 was infectious, circulatory, digestive and respiratory diseases, and in 1947 (selection by rules) infectious, cancer, circulatory and nervous diseases (Table 10 and Fig. 2), the nervous diseases being replaced by the respiratory group under the alternative system of cause selection. Constituting practically the whole of the infectious disease group tuberculosis was by far the most important individual cause of death throughout the entire period.

Causes of death at ages 45–64

The male death rate was 23,936 per million in 1848–72 (Table 8) and 15,040 in 1947, a decrease of just over one-third. The female rate, however, fell from 20,618 to 9042, a decrease of more than a half.

In 1848–72 more than one-fifth of all deaths were due to the infectious diseases, with, as at younger ages, respiratory tuberculosis playing the leading role. The proportionate rates from respiratory tuberculosis in 1848–72 were 151 (male) and 131 (female) per thousand; in 1947 the rates were 76 and 29 per thousand. The male absolute rate declined from 3622 to 1207 per million and the female rate from 2708 to 264 per million. Quite clearly a conspicuous difference between the sexes in degree of improvement has become apparent. If the data were rearranged and re-presented, preferably diagrammatically, it would be seen at once that the curve of tuberculosis mortality in males, when plotted against age, has tended to shift to older ages, while among females the period of maximum mortality has remained at adolescence and early adult ages.

The proportionate rates for cancer increased from 30 to 216 per thousand for men, and from 82 to 306 per thousand for women. Thus at these ages about one male death in five and one female death in three in 1947 were attributed to cancer, which became the leading cause of death of females.

Diseases of the nervous system declined from 126 (male) and 129 (female) to 75 and 118 per thousand, about three-quarters of the deaths being ascribed to intracranial vascular lesions. Other main groups that declined were those of the respiratory and the digestive diseases.

By contrast, deaths from cardiovascular disease increased greatly in men and in women. The increase among men was absolute as well as proportionate, from 2960 to 5160 per million, 124 to 343 per thousand. The female absolute rate, however, declined from 3167 to 2593 per million, while the proportionate rate rose from 154 to 287 per thousand. It is at ages 45–64 that coronary artery disease has become very prevalent, increasing among men from 104 per million in 1901–10 to 1270 per million in 1947 and among women from 39 to 499 per million. The problem of this increasing incidence is discussed in some detail in a recent paper by Ryle & Russell (1949).

The order of the leading causes for men was, in 1848–72, infectious, respiratory, nervous and circulatory diseases, and in 1947 circulatory, cancer, respiratory and

infectious diseases. For women the order in 1848–72 was infectious, respiratory, circulatory and nervous diseases, and in 1947 (selection by rules) cancer, circulatory, nervous, and, sharing fourth place, infectious and respiratory diseases (Table 10 and Fig. 2). In 1947 (selection by certifying medical practitioner's preference) the order of the four leading groups in each sex was unchanged, except that for women the infectious diseases ceased to share the fourth place with the respiratory diseases.

Causes of death at ages 65 and over

Reduction in the total death rates at ages 65 and over has been less than at younger ages. The male rate declined by 19% from 95,625 per million in 1848–72 to 77,762 per million in 1947. The female rate declined by 29% from 86,269 to 61,330 per million.

Among the elderly the infectious diseases are not important causes of death, and in 1947 produced less than 2% of the total mortality from all causes. Half of the male deaths in 1947, but less than one-quarter of female deaths from the infectious diseases, were attributed to respiratory tuberculosis.

The rates from cancer increased from 19 (male) and 30 (female) in 1848–72 to 150 and 138 per thousand in 1947, while deaths from the nervous diseases, of which practically all were cerebral vascular lesions, declined from 135 and 128 to 85 and 109 per thousand.

There was close correspondence between the sexes in the proportion of deaths assigned to circulatory diseases, 107 (male) and 113 (female) rising progressively to 512 and 509 per thousand. Thus just over half of the deaths of elderly persons in 1947 were classified to circulatory diseases; three-fifths of these were described as diseases of the heart valves or muscle, and a further one-fifth for males and one-tenth for females were described as diseases of the coronary arteries.

The group of respiratory diseases diminished greatly in relative importance, chiefly owing to a decline in the number of deaths assigned to bronchitis. The proportion of deaths from pneumonia, on the other hand, increased slightly both among men and women. As was mentioned earlier there has been no dramatic reduction in recent years in the mortality from pneumonia among the elderly comparable with that at younger ages.

Diseases of the digestive system declined from 75 (male) and 78 (female) to 26 and 24 per thousand. In 1848–72 one-third of these were due to diarrhoeal diseases, with absolute rates of 2605 and 2479 (female) per million. In 1947 corresponding rates were 89 and 111 per million.

As shown in Table 10 and Fig. 2 the order of the leading cause groups among men aged 65 and over in 1848–72 was respiratory, nervous, circulatory and digestive diseases and in 1947 (by both systems of selection) circulatory, cancer, nervous and respiratory diseases. Among women the order in 1848–72 was respiratory, nervous, circulatory and digestive diseases, and in 1947 (selection by rules) circulatory, cancer, nervous and respiratory diseases, the position of cancer and the nervous diseases being reversed under the other system of cause selection.

Table 8A. 45–64 *years. Mean annual death rates per million living. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**23,936**	**22,331**	**16,525**	**16,843**	**16,656**	**15,040**
Infectious diseases	5,549	3,551	2,325	2,347	1,835	1,498
Typhoid and paratyphoid		94	18	9	3	1
Typhus	942	1	—	—	—	—
Smallpox	85	23	1	0·5	—	—
Measles	2	1	—	0·2	—	0·2
Scarlet fever	46	2	2	0·5	1	1
Whooping cough	0·4	0·3	—	—	0·5	—
Diphtheria		5	2	4	1	1
Influenza	73	434	395	544	342	137
Cholera	346	—	—	—	—	—
Dysentery	93	15	8	6	6	2
Respiratory tuberculosis	3,622	2,607	1,614	1,427	1,207	1,150
Other tuberculosis	127	186	121	82	71	54
Syphilis	19	39	42	113	115	59
Cancer	715	2,473	2,828	2,926	3,010	3,243
Diabetes mellitus	92	260	206	191	190	94
Anaemia		148	168	105	80	47
Diseases of the nervous system and sense organs	3,014	2,824	1,825	1,356	1,297	1,135
Cerebral haemorrhage, apoplexy, etc.	2,092	1,684	1,107	778	827	726
Diseases of the circulatory system	2,960	4,015	2,984	4,080	5,159	5,160
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	2,239	3,504	2,229	2,886	3,063	2,162
Diseases of the coronary arteries and angina pectoris		104	96	492	1,270	2,007
Diseases of the respiratory system	4,722	3,911	2,555	2,071	1,645	1,551
Bronchitis	2,410	1,490	1,037	677	562	628
Pneumonia (all forms)	1,037	1,911	1,215	1,139	847	566
Diseases of the digestive system	2,499	1,412	1,025	1,109	1,050	751
Ulcer of the stomach		105	140	273	319	218
Ulcer of the duodenum			75	147	148	172
Diarrhoea and enteritis	458	201	90	36	42	21
Appendicitis		65	88	116	99	48
Cirrhosis of the liver		505	228	137	92	55
Non-venereal diseases of the genito-urinary system and annexa	688	1,470	1,022	1,072	809	548
Nephritis	263	1,195	772	780	522	365
Suicide	194	446	391	457	358	254
Other violence	1,368	954	640	625	755	475
Accidental burns	54	23	13	15	15	8
Rail, road and air transport accidents		219	187	243	359	186

Table 8B. 45–64 *years. Proportionate rates per* 1000 *deaths from all causes. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	1,000	1,000	1,000	1,000	1,000	1,000
Infectious diseases	232	159	141	139	110	100
Typhoid and paratyphoid		4	1	1	0·2	0·07
Typhus	39	0·06	—	—	—	—
Smallpox	4	1	0·03	0·03	—	—
Measles	0·07	0·03	—	0·02	—	0·02
Scarlet fever	2	0·08	0·1	0·03	0·06	0·04
Whooping cough	0·02	0·12	—	—	0·03	—
Diphtheria		0·2	0·1	0·2	0·07	0·04
Influenza	3	19	24	32	21	9
Cholera	14	—	—	—	—	—
Dysentery	4	1	0·5	0·4	0·3	0·1
Respiratory tuberculosis	151	117	98	85	72	76
Other tuberculosis	5	8	7	5	4	4
Syphilis	0·8	2	3	7	7	4
Cancer	30	111	171	174	181	216
Diabetes mellitus	4	12	12	11	11	6
Anaemia		7	10	6	5	3
Diseases of the nervous system and sense organs	126	126	110	80	78	75
Cerebral haemorrhage, apoplexy, etc.	87	75	67	46	50	48
Diseases of the circulatory system	124	180	181	242	310	343
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	94	157	135	171	184	144
Diseases of the coronary arteries and angina pectoris		5	6	29	76	133
Diseases of the respiratory system	197	175	155	123	99	103
Bronchitis	101	67	63	40	34	42
Pneumonia (all forms)	43	86	74	68	51	38
Diseases of the digestive system	104	63	62	66	63	50
Ulcer of the stomach		5	8	16	19	15
Ulcer of the duodenum			5	9	9	11
Diarrhoea and enteritis	19	9	5	2	3	1
Appendicitis		3	5	7	6	3
Cirrhosis of the liver		23	14	8	6	4
Non-venereal diseases of the genito-urinary system and annexa	29	66	62	64	49	36
Nephritis	11	54	47	46	31	24
Suicide	8	20	24	27	21	17
Other violence	57	43	39	37	45	32
Accidental burns	2	1	1	1	1	1
Rail, road and air transport accidents		10	11	14	22	12

Table 8C. 45–64 *years. Mean annual death rates per million living. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**20,618**	**17,477**	**12,524**	**12,088**	**10,973**	**9,042**
Infectious diseases	4,374	1,884	1,240	1,126	711	471
Typhoid and paratyphoid		60	13	7	3	
Typhus	818	1	—	—	—	—
Smallpox	45	7	—	—	—	0·2
Measles	2	1	1	1	0·4	1
Scarlet fever	39	2	2	2	2	0·2
Whooping cough	0·5	0·4	1	1	0·2	—
Diphtheria		7	7	8	4	1
Influenza	75	345	294	405	221	69
Cholera	324	—	—	—	—	—
Dysentery	90	13	12	3	3	2
Respiratory tuberculosis	2,708	1,204	712	506	345	264
Other tuberculosis	120	139	104	65	43	41
Syphilis	17	24	20	37	34	21
Cancer	1,701	3,162	3,069	2,930	2,896	2,764
Diabetes mellitus	39	221	208	268	291	158
Anaemia		157	200	144	119	70
Diseases of the nervous system and sense organs	2,665	2,539	1,658	1,183	1,159	1,063
Cerebral haemorrhage, apoplexy, etc.	1,985	1,769	1,185	800	831	706
Diseases of the circulatory system	3,167	3,457	2,414	2,973	3,092	2,593
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	2,206	3,242	2,094	2,423	2,197	1,554
Diseases of the coronary arteries and angina pectoris		39	30	129	335	499
Diseases of the respiratory system	3,497	2,578	1,403	1,002	624	474
Bronchitis	2,152	1,294	661	342	181	154
Pneumonia (all forms)	535	1,026	604	535	355	255
Diseases of the digestive system	2,454	1,302	762	755	573	376
Ulcer of the stomach		88	80	89	72	51
Ulcer of the duodenum			11	20	21	13
Diarrhoea and enteritis	468	180	91	40	37	28
Appendicitis		46	63	92	68	32
Cirrhosis of the liver			93	65	45	29
Non-venereal diseases of the genito-urinary system and annexa	293	1,034	726	695	526	356
Nephritis	149	846	575	584	427	279
Diseases of pregnancy, childbirth and the puerperal state	32	15	13	6	3	2
Puerperal sepsis	8	5	4	0·4	0·4	0·2
Suicide	55	109	117	144	159	146
Other violence	275	245	162	208	219	147
Accidental burns	49	48	26	25	20	13
Rail, road and air transport accidents		25	39	85	78	50

Table 8D. 45–64 *years. Proportionate rates per* 1000 *deaths from all causes. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	212	108	99	93	65	52
Typhoid and paratyphoid		3	1	1	0·3	
Typhus	40	0·07	—	—	—	—
Smallpox	2	0·4	—	—	—	0·02
Measles	0·1	0·07	0·06	0·1	0·04	0·06
Scarlet fever	2	0·1	0·2	0·2	0·2	0·02
Whooping cough	0·02	0·02	0·04	0·07	0·02	—
Diphtheria		0·4	1	1	0·3	0·1
Influenza	4	20	23	33	20	8
Cholera	16	—	—	—	—	—
Dysentery	4	1	1	0·3	0·2	0·2
Respiratory tuberculosis	131	69	57	42	31	29
Other tuberculosis	6	8	8	5	4	5
Syphilis	1	1	2	3	3	2
Cancer	82	181	245	242	264	306
Diabetes mellitus	2	13	17	22	26	17
Anaemia		9	16	12	11	8
Diseases of the nervous system and sense organs	129	145	132	98	106	118
Cerebral haemorrhage, apoplexy, etc.	96	101	95	66	76	78
Diseases of the circulatory system	154	198	193	246	282	287
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	107	186	167	200	200	172
Diseases of the coronary arteries and angina pectoris		2	2	11	31	55
Diseases of the respiratory system	170	147	112	83	57	52
Bronchitis	104	74	53	28	16	17
Pneumonia (all forms)	26	59	48	44	32	28
Diseases of the digestive system	119	75	61	62	52	42
Ulcer of the stomach		5	6	7	7	6
Ulcer of the duodenum			1	2	2	1
Diarrhoea and enteritis	23	10	7	3	3	3
Appendicitis		3	5	8	6	4
Cirrhosis of the liver			7	5	4	3
Non-venereal diseases of the genito-urinary system and annexa	14	59	58	57	48	39
Nephritis	7	48	46	48	39	31
Diseases of pregnancy, childbirth and the puerperal state	2	1	1	1	0·3	0·2
Puerperal sepsis	0·4	0·3	0·3	0·04	0·04	0·02
Suicide	3	6	9	12	14	16
Other violence	13	14	13	17	20	16
Accidental burns	2	3	2	2	2	1
Rail, road and air transport accidents		1	3	7	7	5

Table 9A. 65 *and over. Mean annual death rates per million living. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**95,625**	**88,135**	**77,757**	**84,875**	**80,032**	**77,762**
Infectious diseases	5,725	3,561	2,369	3,152	2,147	1,519
Typhoid and paratyphoid		34	16	5	2	1
Typhus	1,555	—	—	—	—	—
Smallpox	46	17	—	2	—	5
Measles	1	0·3	—	2	—	—
Scarlet fever	60	0·3	—	1	1	—
Whooping cough	1	1	1	—	—	—
Diphtheria		7	1	2	1	—
Influenza	637	1,693	1,239	2,040	1,199	500
Cholera	491	—	—	—	—	—
Dysentery	344	37	20	9	7	3
Respiratory tuberculosis	1,864	1,268	749	669	611	676
Other tuberculosis	154	148	126	83	59	43
Syphilis	11	25	29	94	125	106
Cancer	1,825	7,000	9,361	11,373	11,089	11,699
Diabetes mellitus	145	728	649	931	1,126	639
Anaemia		—	—	326	382	343
Diseases of the nervous system and sense organs	12,941	12,884	9,789	7,845	6,554	6,584
Cerebral haemorrhage, apoplexy, etc.	10,784	9,815	8,525	6,559	5,492	5,585
Diseases of the circulatory system	10,189	15,793	18,649	32,574	37,182	39,833
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	6,748	12,995	12,354	22,885	25,091	24,058
Diseases of the coronary arteries and angina pectoris		341	377	1,914	4,402	7,309
Diseases of the respiratory system	17,049	16,234	13,310	9,858	6,026	5,796
Bronchitis	11,155	10,405	9,151	5,988	3,089	2,925
Pneumonia (all forms)	2,201	4,235	3,094	3,018	2,365	2,485
Diseases of the digestive system	7,197	3,838	2,822	2,764	2,295	2,002
Ulcer of the stomach		132	150	310	403	427
Ulcer of the duodenum			90	207	225	264
Diarrhoea and enteritis	2,605	930	623	177	120	89
Appendicitis		64	97	170	165	97
Cirrhosis of the liver		604	349	328	178	108
Non-venereal diseases of the genito-urinary system and *annexa*	3,145	5,680	5,287	6,584	5,292	4,536
Nephritis	395	2,980	2,448	3,182	2,039	1,678
Suicide	213	474	506	527	462	410
Other violence	1,881	1,557	1,291	1,570	1,875	1,251
Accidental burns	107	83	77	63	57	60
Rail, road and air transport accidents		299	363	594	783	369

Table 9B. 65 *and over. Proportionate rates per* 1000 *deaths from all causes. Males*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	60	40	30	37	27	20
Typhoid and paratyphoid		0·4	0·2	0·06	0·02	0·01
Typhus	16	—	—	—	—	—
Smallpox	0·5	0·2	—	0·02	—	0·07
Measles	0·1	0·003	—	0·02	—	—
Scarlet fever	1	0·003	—	0·01	0·008	—
Whooping cough	0·007	0·02	0·1	—	—	—
Diphtheria		0·08	0·1	0·03	0·02	—
Influenza	7	19	16	24	15	6
Cholera	5	—	—	—	—	—
Dysentery	4	0·4	0·3	0·1	0·09	0·03
Respiratory tuberculosis	19	14	10	8	8	9
Other tuberculosis	2	2	2	1	0·8	1
Syphilis	0·1	0·3	0·4	1	2	1
Cancer	19	79	120	134	139	150
Diabetes mellitus	2	8	8	11	14	8
Anaemia		—	—	4	5	4
Diseases of the nervous system and sense organs	135	146	126	92	82	85
Cerebral haemorrhage, apoplexy, etc.	113	111	110	77	69	72
Diseases of the circulatory system	107	179	240	384	465	512
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	71	147	159	270	314	309
Diseases of the coronary arteries and angina pectoris		4	5	23	55	94
Diseases of the respiratory system	178	184	171	116	75	75
Bronchitis	117	118	118	71	39	38
Pneumonia (all forms)	23	48	40	36	30	32
Diseases of the digestive system	75	44	36	33	29	26
Ulcer of the stomach		2	2	4	5	5
Ulcer of the duodenum			1	2	3	3
Diarrhoea and enteritis	27	11	8	2	1	1
Appendicitis		1	1	2	2	1
Cirrhosis of the liver		7	4	4	2	1
Non-venereal diseases of the genito-urinary system and annexa	33	64	68	78	66	58
Nephritis	4	34	31	37	25	22
Suicide	2	5	7	6	6	5
Other violence	20	18	17	18	23	16
Accidental burns	1	1	1	1	1	1
Rail, road and air transport accidents		3	5	7	10	5

Table 9C. 65 *and over. Mean annual death rates per million living. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**86,269**	**78,312**	**68,187**	**74,588**	**66,396**	**61,330**
Infectious diseases	4,455	2,933	2,021	2,999	1,708	831
Typhoid and paratyphoid		24	8	7	3	—
Typhus	1,215	0·1	—	—	—	—
Smallpox	22	6	—	—	—	1
Measles	1	1	—	1	—	1
Scarlet fever	43	1	2	—	—	0·4
Whooping cough	1	2	3	1	—	0·4
Diphtheria		6	5	4	1	1
Influenza	679	1,844	1,300	2,353	1,303	442
Cholera	462	—	—	—	—	—
Dysentery	309	36	35	6	5	5
Respiratory tuberculosis	1,175	638	406	335	224	198
Other tuberculosis	124	138	118	79	56	39
Syphilis	6	15	14	26	25	26
Cancer	2,548	7,026	8,229	9,282	8,610	8,469
Diabetes mellitus	44	544	636	1,190	1,386	939
Anaemia		187	297	330	439	408
Diseases of the nervous system and sense organs	11,078	11,511	9,250	7,452	6,249	6,665
Cerebral haemorrhage, apoplexy, etc.	9,620	9,193	8,348	6,601	5,500	6,099
Diseases of the circulatory system	9,735	13,510	16,153	28,820	31,196	31,214
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	5,746	11,910	12,386	22,235	23,032	21,149
Diseases of the coronary arteries and angina pectoris		155	166	878	2,211	3,609
Diseases of the respiratory system	14,192	14,993	11,757	9,200	4,797	3,741
Bronchitis	10,244	10,447	8,484	5,839	2,472	1,650
Pneumonia (all forms)	1,521	3,343	2,410	2,612	1,887	1,823
Diseases of the digestive system	6,753	3,639	2,668	2,319	1,798	1,476
Ulcer of the stomach		93	106	169	173	180
Ulcer of the duodenum			21	29	44	57
Diarrhoea and enteritis	2,479	923	650	202	122	111
Appendicitis		53	85	126	125	77
Cirrhosis of the liver		349	143	113	76	42
Non-venereal diseases of the genito-urinary system and annexa	544	2,307	2,037	2,697	1,827	1,416
Nephritis	212	1,897	1,685	2,388	1,541	1,191
Diseases of pregnancy, childbirth and the puerperal state	—	—	—	—	—	0·4
Puerperal sepsis	—	—	—	—	—	—
Suicide	51	76	77	112	133	149
Other violence	1,095	1,131	978	1,469	1,651	1,239
Accidental burns	280	167	130	148	117	117
Rail, road and air transport accidents		65	105	268	269	141

Table 9D. 65 *and over. Proportionate rates per* 1000 *deaths from all causes. Females*

	1848–72	1901–10	1921	1931	1939	1947
All causes	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**
Infectious diseases	52	37	30	40	26	14
Typhoid and paratyphoid		0·3	0·1	0·1	0·05	—
Typhus	14	0·001	—	—	—	—
Smallpox	0·3	0·08	—	—	—	0·01
Measles	0·01	0·01	—	0·01	—	0·02
Scarlet fever	0·5	0·01	0·02	—	—	0·01
Whooping cough	0·01	0·02	0·05	0·01	—	0·01
Diphtheria		0·8	0·08	0·06	0·02	0·01
Influenza	8	24	19	32	20	7
Cholera	5	—	—	—	—	—
Dysentery	4	0·5	1	0·08	0·08	0·09
Respiratory tuberculosis	14	8	6	4	3	3
Other tuberculosis	1	2	2	1	1	1
Syphilis	0·07	0·2	0·2	0·3	0·4	0·4
Cancer	30	90	121	124	130	138
Diabetes mellitus	1	7	9	16	21	15
Anaemia		2	4	4	7	7
Diseases of the nervous system and sense organs	128	147	136	100	94	109
Cerebral haemorrhage, apoplexy, etc.	112	117	122	89	83	99
Diseases of the circulatory system	113	173	237	386	470	509
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	67	152	182	298	347	345
Diseases of the coronary arteries and angina pectoris		2	2	12	33	59
Diseases of the respiratory system	165	191	172	123	72	61
Bronchitis	119	133	124	78	37	27
Pneumonia (all forms)	18	43	35	35	28	30
Diseases of the digestive system	78	46	39	31	27	24
Ulcer of the stomach		1	2	2	3	3
Ulcer of the duodenum			0·3	0·4	1	1
Diarrhoea and enteritis	29	12	10	3	2	2
Appendicitis		1	1	2	2	1
Cirrhosis of the liver		4	2	2	1	1
Non-venereal diseases of the genito-urinary system and annexa	6	29	30	36	28	23
Nephritis	2	24	25	32	23	19
Diseases of pregnancy, childbirth and the puerperal state	—	—	—	—	—	0·01
Puerperal sepsis	—	—	—	—	—	—
Suicide	1	1	1	2	2	2
Other violence	13	14	14	20	25	20
Accidental burns	3	2	2	2	2	2
Rail, road and air transport accidents		1	2	4	4	2

Summary of changes in the proportionate distribution of deaths

Table 10 and Fig. 2, to both of which frequent reference has already been made, set out the four leading groups of causes of death at each age in 1848–72 and 1947. Presented thus it is possible to see fairly easily what have been the chief changes at different ages. In view of their special importance within the infectious diseases group the proportionate rates for tuberculosis (all forms) are shown in Table 10 in parentheses after the rates for the whole group.

The most important changes in *proportionate* distribution during the 100-year period have been:

(1) At each age a decline in deaths from infectious diseases other than tuberculosis.
(2) At each age except the elderly an increase in deaths from violence.
(3) An increase in deaths from tuberculosis among children and young women.
(4) An increase at adult ages in deaths from circulatory diseases.
(5) An increase at each age in deaths from cancer.

As has been mentioned earlier, the proportionate distribution of the leading groups of causes of death in 1947 (selection by certifying medical practitioner's preference) is given in Appendix 2 and is also shown in Fig. 2.

Summary of changes in absolute death rates

Attention has been directed in the foregoing pages chiefly towards proportionate rates and the *relative* importance of the various causes of death. Although changes in absolute rates have not been entirely ignored, much less attention has been paid to them. Whenever proportionate rates and their trends are under consideration it is necessary to keep a watchful eye upon absolute levels, provided these can be ascertained. If this is not done quite erroneous conclusions may be drawn. For instance, it was stated in the previous section that between 1848–72 and 1947 there had been an increase in tuberculosis as a cause of death among children and young women. Thus among girls aged 1–4 the proportionate rate from tuberculosis (all forms) rose from 105 to 162 per thousand. Table 4C, however, shows that the absolute death rate fell from 3716 to 319 per million, a decrease of over 90%. It would have been a serious error to have concluded, on the basis of the proportionate rates, that the mortality from tuberculosis had risen.

Table 11 summarizes the changes that have taken place in the absolute death rates from the main groups of diseases, the figures shown in the table being the rates per million in 1947 (selection by rules) expressed as percentages of the corresponding rates in 1848–72. A more detailed tabulation of changes between 1848–72 and 1901–10 and between 1901–10 and 1947 is given at Appendix 3.

There has been a large absolute increase in the number of deaths attributed to cancer and to circulatory disease and once more it has to be observed how great has been the increase in deaths assigned to disease of the coronary arteries. Even since 1939 the death rate from coronary disease has practically doubled.

By 1947 the death rate from scarlet fever had fallen to 1% of the rate in 1901–10. Diphtheria declined to 3%, measles to 5% and whooping cough to 8%.

Table 10. *The leading groups of causes of death in* 1848–1872 *and in* 1947 (*selection by rules*)

Rates per thousand deaths from all causes

The figures in parentheses are for tuberculosis (all forms).

	Males				Females			
	1848–72		1947		1848–72		1947	
All ages	Infectious diseases	321 (146)	Circulatory diseases	386	Infectious diseases	338 (155)	Circulatory diseases	394
	Respiratory diseases	148	Cancer	149	Respiratory diseases	134	Cancer	161
	Nervous diseases	129	Respiratory diseases	91	Nervous diseases	117	Nervous diseases	101
	Digestive diseases	83	Nervous diseases	76	Digestive diseases	85	Respiratory diseases	68
Under 1	Developmental and wasting diseases	266	Developmental and wasting diseases	453	Developmental and wasting diseases	269	Developmental and wasting diseases	461
	Nervous diseases	210	Respiratory diseases	185	Nervous diseases	196	Respiratory diseases	189
	Infectious diseases	178 (64)	Digestive diseases	142	Infectious diseases	193 (62)	Digestive diseases	134
	Respiratory diseases	150	Infectious diseases	48 (10)	Respiratory diseases	141	Infectious diseases	56 (9)
1–4	Infectious diseases	544 (118)	Infectious diseases	331 (151)	Infectious diseases	557 (105)	Infectious diseases	390 (163)
	Respiratory diseases	172	Respiratory diseases	204	Respiratory diseases	171	Respiratory diseases	204
	Nervous diseases	85	Violence (excluding suicide)	151	Nervous diseases	81	Violence (excluding suicide)	117
	Digestive diseases	63	Digestive diseases	92	Digestive diseases	64	Digestive diseases	70
5–14	Infectious diseases	618 (164)	Violence (excluding suicide)	333	Infectious diseases	690 (192)	Infectious diseases	325 (202)
	Violence (excluding suicide)	103	Infectious diseases	241 (129)	Nervous diseases	68	Violence (excluding suicide)	169
	Nervous diseases	72	Digestive diseases	74	Respiratory diseases	62	Digestive diseases	82
	Respiratory diseases	59	Nervous diseases	62	Digestive diseases	41	Respiratory diseases	79
15–24	Infectious diseases	619 (433)	Infectious diseases	351 (308)	Infectious diseases	678 (501)	Infectious diseases	586 (549)
	Violence (excluding suicide)	118	Violence (excluding suicide)	236	Nervous diseases	53	Circulatory diseases	71
	Respiratory diseases	55	Circulatory diseases	75	Circulatory diseases	48	Nervous diseases	47
	Nervous diseases	53	Nervous diseases	68	Digestive diseases	48	Maternal causes	43
25–44	Infectious diseases	487 (370)	Infectious diseases	284 (259)	Infectious diseases	509 (400)	Infectious diseases	293 (267)
	Respiratory diseases	102	Circulatory diseases	156	Circulatory diseases	78	Cancer	180
	Violence (excluding suicide)	92	Cancer	125	Digestive diseases	75	Circulatory diseases	138
	Nervous diseases	82	Violence (excluding suicide)	122	Respiratory diseases	73	Nervous diseases	72
45–64	Infectious diseases	232 (157)	Circulatory diseases	343	Infectious diseases	212 (137)	Cancer	306
	Respiratory diseases	197	Cancer	216	Respiratory diseases	170	Circulatory diseases	287
	Nervous diseases	126	Respiratory diseases	103	Circulatory diseases	154	Nervous diseases	118
	Circulatory diseases	124	Infectious diseases	100 (80)	Nervous diseases	129	Infectious and respiratory diseases	52 (34)
65 and over	Respiratory diseases	178	Circulatory diseases	512	Respiratory diseases	165	Circulatory diseases	509
	Nervous diseases	135	Cancer	150	Nervous diseases	128	Cancer	138
	Circulatory diseases	107	Nervous diseases	85	Circulatory diseases	113	Nervous diseases	109
	Digestive diseases	75	Respiratory diseases	75	Digestive diseases	78	Respiratory diseases	61

Table 11. *Death rates in* 1947 *(selection by rules) percent of corresponding rates in* 1848–72

	Males								Females							
	All ages	Under 1 year	1–4	5–14	15–24	25–44	45–64	65 and over	All ages	Under 1 year	1–4	5–14	15–24	25–44	45–64	65 and over
All causes	**58**	**23**	**7**	**14**	**24**	**25**	**63**	**81**	**53**	**23**	**6**	**10**	**20**	**22**	**44**	**71**
Infectious diseases	13	6	4	5	14	14	27	27	9	7	4	5	17	12	11	19
Tuberculosis (all forms)	20	4	8	11	17	17	32	36	12	3	9	11	21	14	11	18
Cancer	920	170	370	333	309	297	453	640	377	204	294	213	164	117	162	333
Diseases of the nervous system and sense organs	34	3	5	12	31	19	38	51	46	3	4	11	17	24	40	60
Diseases of the circulatory system	418	2	2	13	42	52	174	391	328	4	4	12	29	38	82	321
Diseases of the respiratory system	36	29	8	12	21	16	33	34	27	30	7	13	16	16	14	26
Diseases of the digestive system	32	29	10	24	26	24	30	28	23	26	6	21	14	12	15	22
Non-venereal diseases of the genito-urinary system and annexa	186	221	40	48	71	47	80	144	231	196	34	77	102	88	122	260
Maternal causes	—	—	—	—	—	—	—	—	20	—	—	—	28	18	6	—
Violence (excluding suicide)	46	66	30	44	48	33	35	67	73	61	27	43	53	49	53	113
Developmental and wasting diseases	—	40	—	—	—	—	—	—	—	39	—	—	—	—	—	—

Pneumonia gave death rates in 1947, that were 42% of those in 1901–10. Meanwhile bronchitis fell to 22% for females but only to 40% for males. At ages 15–24, which includes the ages of military service, the male rate dropped only to 77%.

Although there was a reduction in the death rate from violence (excluding suicide) there was a considerable increase in deaths resulting from transport accidents. The male rate at all ages increased by 40% between 1901–10 and 1947, but at ages from 5 to 24 the rate doubled. Among women the increase was much greater, to 260% at all ages, to 322% at 5–14, to 457% at 15–24 and to over 200% or more at higher ages. The excessive rise in female mortality compared with male has been the result of the greatly increased number of women who have gone out to work in the past two or three decades, and who, in travelling to and from work, share with men the risk of being involved in transport accidents. Moreover, housewives out shopping risk their lives each time they cross the road.

The effect of the diminished mortality (all causes) at all ages between 1848–72 and 1947 is demonstrated in Table 12, which shows, for each age, the number of deaths recorded in 1947 and the number that there would have been if no reduction in mortality had taken place.

Table 12. *Deaths from all causes at various ages in* 1947. *Actual numbers and numbers that would have occurred at rates prevailing in* 1848–72

Age	Males		Females		Persons		
	Actual number in 1947	Number in 1947 at 1848–1872 rate	Actual number in 1947	Number in 1947 at 1848–1872 rate	Actual number in 1947	Number in 1947 at 1848–1872 rate	Difference
Under 1	21,225	90,587	15,624	68,969	36,849	159,556	122,707
1–4	3,240	49,444	2,525	45,775	5,765	95,219	89,454
5–14	2,595	19,000	1,875	18,088	4,470	37,088	32,618
15–24	3,986	16,467	4,512	23,099	8,498	39,566	31,068
25–44	17,657	71,960	15,763	73,198	33,420	145,158	111,738
45–64	68,899	109,651	48,992	111,708	117,891	221,359	103,468
65 and over	148,137	182,166	160,561	225,852	308,698	408,018	99,320
All ages	**265,739**	**539,275**	**249,852**	**566,689**	**515,591**	**1,105,964**	**590,373**

Altogether there were 515,591 civilian deaths registered in England and Wales in 1947. At the death rates prevailing in 1848–72 there would have been 1,105,964 deaths. Half a million persons died in England and Wales in 1947. If there had been no improvement in mortality over half a million more would have died. This is a measure of the progress that has been made in 100 years.

Conclusion

To review fully the changing causes of mortality in England and Wales during the past 100 years is impossible within the limits of a relatively short study such as this. Many matters, some of undoubted interest, even of importance, have been touched on but superficially, or even entirely ignored. It has been practicable to draw attention only to the most outstanding changes—the huge decline in mortality from the infectious diseases, the maintenance of tuberculosis as the most important cause

of death in young adults, the increasing relative importance, especially at younger ages, of deaths from violence, and the ascendancy in middle and late adult life of the cardio-vascular diseases and of cancer.

The object here has been to present a series of age-specific death rates, comparable as far as possible from one period to another, so that the trends of mortality can be observed free from the discontinuities of classification and of terminology that necessarily occur in the long series of official statistics.

Space has prevented adequate discussion of reasons for the changing pattern of mortality. Suggested explanations will be found in several of the works mentioned in the bibliography (e.g. Greenwood, 1936, and Stocks, 1950), and only the briefest outline can be given here. The reduction or elimination of some of the infectious diseases can be related directly to definite preventive measures such as vaccination (smallpox), immunization (diphtheria) and improved sanitation (cholera and typhoid). The prevalence or the fatality of other diseases have declined because of less specific measures associated with a higher standard of living—better food, clothing and housing, purer air, earlier and fuller medical attention. Special *ad hoc* public health services, maternity and child welfare, venereal disease and tuberculosis clinics and the like, have reduced the risk of death among certain groups. The medical inspection of schoolchildren prevents serious defects remaining undetected and untreated. In industry special hazards have been recognized and the workers protected; conditions in workshops and in factories have been improved and hours of work reduced.

In parallel with these preventive measures there have been great advances in curative medicine and surgery. The safety of anaesthesia has been increased, surgical technique continuously improved, and the field of successful surgical intervention widened. Traumatic surgery, the surgical treatment of injuries, has reduced greatly the ratio of fatal to non-fatal accidents. A compound fracture nowadays is a misfortune, not a death warrant. Blood transfusion has saved the lives of numerous mothers and new-born babies as well as persons who have been seriously injured. Radiotherapy has assisted in reducing the fatality of cancer. Insulin has preserved into old age diabetics who would otherwise have died prematurely. Liver therapy has changed the outlook for those with pernicious anaemia. In recent years the sulphonamides, penicillin and streptomycin have revolutionized the treatment of numerous infections, and diseases for which the prognosis 10 years ago would have been very grave now show a high proportion of recoveries.

These are some of the reasons why mortality has declined. It is more difficult to explain the rising incidence of circulatory diseases, especially of the coronary arteries, and of cancer of certain sites, notably the lungs. The mental strains of modern life have been suggested for the former, petrol and road tar fumes for the latter, tobacco for both; but evidence as yet is scarce or absent.

When the means of preventing death from coronary disease, from cancer, from violence, and from tuberculosis have been found—and the means will be found—the pattern of mortality will undergo an even greater change in the future than it has done in the past 100 years.

APPENDICES

APPENDIX I A. *Deaths from certain causes per million living.* 1947. (*Selection by certifying medical practitioner's preference.*) *Males*

	All ages	Under 1 year	1–4	5–14	15–24	25–44	45–64	65 and over
All causes	**13,550**	**47,483**	**2,384**	**913**	**1,834**	**2,800**	**15,040**	**77,762**
Infectious diseases	982	2,159	773	220	651	812	1,544	1,583
Typhoid and paratyphoid	1	2	1	—	1	1	1	1
Typhus	—	—	—	—	—	—	—	—
Smallpox	1	—	—	0·4	—	—	—	5
Measles	17	315	124	9	—	0·2	0·2	—
Scarlet fever	1	4	4	2	0·5	0·2	1	—
Whooping cough	20	573	94	1	—	—	—	—
Diphtheria	6	20	34	19	2	1	1	—
Influenza	87	228	26	5	16	20	120	439
Cholera	—	—	—	—	—	—	—	—
Dysentery	2	22	6	0·4	1	2	2	2
Respiratory tuberculosis	595	119	63	21	457	653	1,117	656
Other forms of tuberculosis	87	327	301	97	96	53	55	44
Syphilis	81	96	—	1	5	17	177	317
Cancer	1,976	43	69	32	72	357	3,210	11,249
Diabetes mellitus	59	—	4	6	10	15	61	395
Anaemia	39	7	3	3	5	6	38	274
Diseases of the nervous system and sense organs	1,448	1,374	152	54	117	157	1,367	10,451
Cerebral haemorrhage	1,260	58	9	4	12	57	1,153	9,973
Convulsions under 5	—	418	12	—	—	—	—	—
Diseases of the circulatory system	4,201	16	6	31	126	379	4,128	31,866
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	2,583	2	4	30	114	225	1,896	21,104
Diseases of the coronary arteries and angina pectoris	1,121	—	—	—	2	122	1,841	6,705
Diseases of the respiratory system	1,813	9,054	502	54	101	228	2,315	9,660
Bronchitis	978	1,087	83	10	23	83	1,335	6,225
Pneumonia	632	7,839	385	35	56	93	584	2,562
Diseases of the digestive system	613	6,740	220	68	83	172	751	2,002
Ulcer of the stomach	109	4	—	—	5	40	225	440
Ulcer of the duodenum	83	11	1	—	6	43	177	272
Diarrhoea and enteritis	167	6,085	109	4	6	13	24	99
Appendicitis	44	2	47	40	38	24	52	106
Cirrhosis of the liver	27	4	1	1	2	8	56	110
Non-venereal diseases of the genito-urinary system and annexa	658	179	32	27	61	113	583	4,826
Nephritis	328	56	20	21	58	97	397	1,974
Diseases of skin and cellular tissue	18	148	5	1	3	5	19	74
Suicide	137	—	—	1	52	100	254	410
Other violence	496	1,588	361	304	432	342	475	1,251
Accidental burns	15	47	54	8	3	4	8	58
Rail, road and air transport accidents	183	4	133	144	217	148	189	376

APPENDIX I B. *Deaths from certain causes per thousand all causes.* 1947. (*Selection by certifying medical practitioner's preference.*) *Males*

	All ages	Under 1 year	1–4	5–14	15–24	25–44	45–64	65 and over
All causes	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Infectious diseases	72	45	324	241	355	290	103	20
Typhoid and paratyphoid	0·07	0·05	0·3	—	1	0·4	0·07	0·01
Typhus	—	—	—	—	—	—	—	—
Smallpox	0·04	—	—	0·4	—	—	—	0·07
Measles	1	7	52	10	—	0·06	0·02	—
Scarlet fever	0·06	0·09	2	2	0·3	0·06	0·04	—
Whooping cough	1	12	40	1	—	—	—	—
Diphtheria	0·5	0·4	14	21	1	0·3	0·04	—
Influenza	6	5	11	5	9	7	8	6
Cholera	—	—	—	—	—	—	—	—
Dysentery	0·2	0·5	2	0·4	1	1	0·1	0·03
Respiratory tuberculosis	44	2	27	24	249	233	74	8
Other forms of tuberculosis	6	7	126	107	52	19	4	1
Syphilis	6	2	—	2	3	6	12	4
Cancer	146	1	29	35	39	127	213	145
Diabetes mellitus	4	—	2	6	5	5	4	5
Anaemia	3	0·1	1	3	3	2	3	4
Diseases of the nervous system and sense organs	107	29	64	59	64	56	91	134
Cerebral haemorrhage	93	1	4	5	6	20	77	128
Convulsions under 5	—	9	5	—	—	—	—	—
Diseases of the circulatory system	310	0·3	2	34	69	135	274	410
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	191	0·05	2	33	62	80	126	271
Diseases of the coronary arteries and angina pectoris	83	—	—	—	1	44	122	86
Diseases of the respiratory system	134	191	210	59	55	81	154	124
Bronchitis	72	23	35	11	13	30	89	80
Pneumonia	47	165	161	38	30	33	39	33
Diseases of the digestive system	45	142	92	74	45	62	50	26
Ulcer of the stomach	8	0·09	—	—	3	14	15	6
Ulcer of the duodenum	6	0·2	0·3	—	3	15	12	3
Diarrhoea and enteritis	12	128	46	4	4	5	2	1
Appendicitis	3	0·05	20	44	21	9	3	1
Cirrhosis of the liver	2	0·09	0·6	1	1	3	4	1
Non-venereal diseases of the genito-urinary system and annexa	49	4	14	30	33	40	39	62
Nephritis	24	1	8	23	32	35	26	25
Diseases of the skin and cellular tissue	1	3	2	1	2	2	1	1
Suicide	10	—	—	2	29	36	17	5
Other violence	37	33	151	333	236	122	32	16
Accidental burns	1	1	23	8	2	1	1	1
Rail, road and air transport accidents	13	0·09	56	157	118	53	13	5

APPENDIX 1 C. *Deaths from certain causes per million living.* 1947. (*Selection by certifying medical practitioner's preferences.*) *Females*

	All ages	Under 1 year	1–4	5–14	15–24	25–44	45–64	65 and over
All causes	**11,268**	**36,762**	**1,956**	**683**	**1,527**	**2,345**	**9,042**	**61,330**
Infectious diseases	643	1,936	740	220	886	680	467	822
Typhoid and paratyphoid	0·5	—	—	—	1	0·1	1	—
Typhus	—	—	—	—	—	—	—	—
Smallpox	0·2	—	—	—	—	0·1	0·2	1
Measles	14	261	120	9	2	0·1	1	1
Scarlet fever	1	2	6	4	1	0·1	0·2	0·4
Whooping cough	23	725	148	7	—	0·1	—	0·4
Diphtheria	5	16	33	17	2	1	1	1
Influenza	72	176	28	6	11	13	61	391
Cholera	—	—	—	—	—	—	—	—
Dysentery	1	9	—	0·4	0·3	1	2	4
Respiratory tuberculosis	364	106	58	43	715	567	259	194
Other forms of tuberculosis	73	219	259	94	109	48	37	31
Syphilis	32	94	—	1	4	10	54	118
Cancer	1,754	49	55	18	43	421	2,710	8,066
Diabetes mellitus	107	2	2	4	10	16	115	606
Anaemia	59	26	5	5	4	10	58	340
Diseases of the nervous system and sense organs	1,672	1,042	124	47	70	156	1,363	10,580
Cerebral haemorrhage	1,511	54	3	2	8	68	1,177	10,166
Convulsions under 5	—	275	19	—	—	—	—	—
Diseases of the circulatory system	3,681	26	9	29	104	309	2,143	25,796
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	2,740	9	6	28	96	262	1,430	19,432
Diseases of the coronary arteries and angina pectoris	504	—	—	—	1	20	454	3,281
Diseases of the respiratory system	1,136	7,148	411	59	69	158	764	6,133
Bronchitis	554	856	62	16	14	46	343	3,666
Pneumonia	463	6,167	326	34	37	61	274	1,960
Diseases of the digestive system	407	4,871	135	55	50	94	372	1,461
Ulcer of the stomach	38	5	—	0·4	2	7	54	191
Ulcer of the duodenum	11	—	—	—	1	3	14	59
Diarrhoea and enteritis	117	4,438	67	3	10	18	29	114
Appendicitis	29	2	29	32	14	13	32	78
Cirrhosis of the liver	14	—	—	1	2	6	29	42
Non-venereal diseases of the genito-urinary system and annexa	338	106	19	24	58	121	383	1,647
Nephritis	280	33	15	20	49	89	307	1,418
Diseases of pregnancy, childbirth and the puerperal state	48	—	—	—	71	124	2	0·4
Puerperal sepsis	11	—	—	—	14	28	0·2	—
Diseases of the skin and cellular tissue	16	96	4	1	7	5	16	67
Suicide	76	—	—	—	20	66	146	149
Other violence	258	1,334	229	113	62	61	145	1,215
Accidental burns	25	47	62	17	3	3	13	116
Rail, road and air transport accidents	53	12	77	59	33	24	50	142

APPENDIX I D. *Deaths from certain causes per thousand all causes.* 1947. (*Selection by certifying medical practitioner's preference.*) *Females*

	All ages	Under 1 year	1–4	5–14	15–24	25–44	45–64	65 and over
All causes	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Infectious diseases	57	53	378	322	580	290	52	13
Typhoid and paratyphoid	0·04	—	—	—	0·4	0·06	0·1	—
Typhus	—	—	—	—	—	—	—	—
Smallpox	0·02	—	—	—	—	0·06	0·02	0·01
Measles	1	7	61	14	2	0·06	0·06	0·02
Scarlet fever	0·1	0·06	3	5	1	0·06	0·02	0·006
Whooping cough	2	20	76	10	—	0·06	—	0·006
Diphtheria	0·5	0·4	17	26	2	0·4	0·1	0·01
Influenza	6	5	14	9	7	6	7	6
Cholera	—	—	—	—	—	—	—	—
Dysentery	0·1	0·3	—	1	0·2	0·3	0·2	0·07
Respiratory tuberculosis	32	3	30	63	469	242	29	3
Other forms of tuberculosis	6	6	132	137	72	20	4	0·5
Syphilis	3	3	—	1	2	4	6	2
Cancer	156	1	28	27	28	180	300	132
Diabetes mellitus	9	0·06	1	6	6	7	13	10
Anaemia	5	1	2	8	3	4	6	6
Diseases of the nervous system and sense organs	148	28	63	69	46	66	151	173
Cerebral haemorrhage	134	1	2	3	6	29	130	166
Convulsions under 5	—	7	10	—	—	—	—	—
Diseases of the circulatory system	327	1	4	43	68	132	237	421
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	243	0·3	3	42	63	112	158	317
Diseases of the coronary arteries and angina pectoris	45	—	—	—	1	9	50	53
Diseases of the respiratory system	101	194	210	86	45	67	85	100
Bronchitis	49	23	32	23	9	19	38	60
Pneumonia	41	168	167	50	24	26	30	32
Diseases of the digestive system	36	132	69	81	33	40	41	24
Ulcer of the stomach	3	0·1	—	1	1	3	6	3
Ulcer of the duodenum	1	—	—	—	0·4	1	2	1
Diarrhoea and enteritis	10	121	34	5	6	8	3	2
Appendicitis	3	0·06	15	46	9	6	4	1
Cirrhosis of the liver	1	—	—	2	1	3	3	0·7
Non-venereal diseases of the genito-urinary system and annexa	30	3	10	36	38	51	42	27
Nephritis	25	1	8	30	32	38	34	23
Diseases of pregnancy, childbirth and the puerperal state	4	—	—	—	47	52	0·2	0·006
Puerperal sepsis	1	—	—	—	9	12	0·02	—
Diseases of the skin and cellular tissue	1	3	2	1	4	2	2	1
Suicide	7	—	—	—	13	28	16	2
Other violence	23	36	117	166	41	26	16	20
Accidental burns	2	1	32	25	2	1	1	2
Rail, road and air transport accidents	5	0·3	39	86	21	10	6	2

APPENDIX 2. *The leading groups of causes of death in* 1947 *(selection by certifying medical practitioner's preference)*

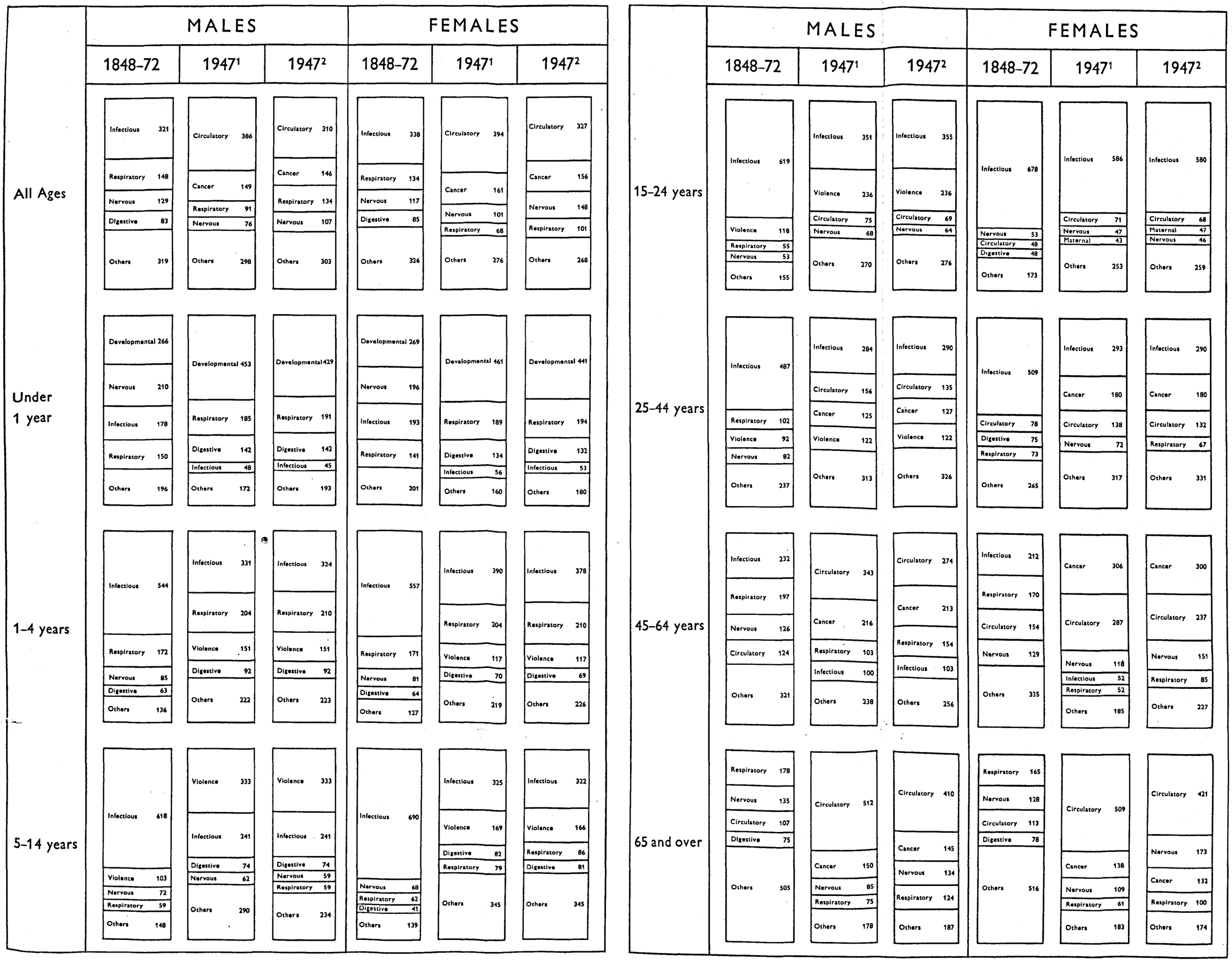
Rates per thousand deaths from all causes
The figures in parentheses are for tuberculosis (all forms).

	Males		Females	
All ages	Circulatory diseases	310	Circulatory diseases	327
	Cancer	146	Cancer	156
	Respiratory diseases	134	Nervous diseases	148
	Nervous diseases	107	Respiratory diseases	101
Under 1	*Developmental and wasting diseases*	429	Developmental and wasting diseases	441
	Respiratory diseases	191	Respiratory diseases	194
	Digestive diseases	142	Digestive diseases	132
	Infectious diseases	45 (9)	Infectious diseases	53 (9)
1–4	Infectious diseases	324 (153)	Infectious diseases	378 (162)
	Respiratory diseases	210	Respiratory diseases	210
	Violence (excluding suicide)	151	Violence (excluding suicide)	117
	Digestive diseases	92	Digestive diseases	69
5–14	Violence (excluding suicide)	333	Infectious diseases	322 (201)
	Infectious diseases	241 (130)	Violence (excluding suicide)	166
	Digestive diseases	74	Respiratory diseases	86
	Nervous diseases	59	Digestive diseases	81
	Respiratory diseases	59		
15–24	Infectious diseases	355 (302)	Infectious diseases	580 (540)
	Violence (excluding suicide)	236	Circulatory diseases	68
	Circulatory diseases	69	Maternal causes	47
	Nervous diseases	64	Nervous diseases	46
25–44	Infectious diseases	290 (252)	Infectious diseases	290 (262)
	Circulatory diseases	135	Cancer	180
	Cancer	127	Circulatory diseases	132
	Violence (excluding suicide)	122	Respiratory diseases	67
45–64	Circulatory diseases	274	Cancer	300
	Cancer	213	Circulatory diseases	237
	Respiratory diseases	154	Nervous diseases	151
	Infectious diseases	103 (78)	Respiratory diseases	85
65 and over	Circulatory diseases	410	Circulatory diseases	421
	Cancer	145	Nervous diseases	173
	Nervous diseases	134	Cancer	132
	Respiratory diseases	124	Respiratory diseases	100

APPENDIX 3. *Death rates from certain causes by sex and age.*

A. Absolute death rates in 1901–10 percent of rates in 1848–72.
B. Absolute death rates in 1947 (selection by rules) percent of rates in 1901–10.

Males	All ages		Under 1		1–4		5–14		15–24		25–44		45–64		65+	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
All causes	70	83	82	28	52	13	42	33	48	51	63	39	93	67	92	88
Infectious diseases	44	29	53	12	41	10	31	17	36	39	50	28	64	42	62	43
Typhoid and paratyphoid		1		18		3		—		1		1		1		3
Typhus	0	—	—	—	0	—	0	—	0	—	0	—	0	—	—	—
Smallpox	5	6	2	—	2	—	3	6	4	—	11	—	27	—	37	29
Measles	75	5	113	10	87	5	62	10	38	—	50	10	50	20	30	—
Scarlet fever	8	1	5	2	9	1	10	1	17	2	14	3	4	50	1	—
Whooping cough	54	8	79	11	57	8	41	3	30	—	50	—	75	—	100	—
Diphtheria		3		6		3		7		13		14		20		—
Influenza	318	45	104	47	135	31	260	19	678	30	867	17	595	32	266	30
Cholera	0	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—
Dysentery	11	33	7	60	4	140	3	80	10	50	23	30	16	13	11	8
Respiratory tuberculosis	54	45	22	28	34	21	26	14	37	42	53	31	72	44	68	53
Other tuberculosis	59	16	59	5	54	16	78	24	107	40	140	28	146	29	96	29
Syphilis	92	50	105	6	91	—	200	50	46	17	97	21	205	151	227	424
Cancer	351	262	170	100	212	175	200	167	186	166	207	143	346	131	384	167
Diabetes mellitus	271	89	200	—	166	80	200	43	178	24	148	25	283	36	502	88
Anaemia		89		4		12		33		38		18		32		—
Diseases of the nervous system and sensory organs	63	54	48	7	49	10	54	22	61	51	65	30	94	40	100	51
Cerebral haemorrhage, apoplexy, etc.	77	99	8	132	6	82	10	67	19	47	30	33	80	43	91	57
Infantile convulsions (under 5)	—	—	42	2	26	2	—	—	—	—	—	—	—	—	—	—
Diseases of the circulatory system	128	326	18	13	23	11	65	20	80	52	83	62	136	129	155	252
Heart diseases (excluding diseases of the coronary arteries and *angina pectoris*)	157	214	53	2	81	6	101	19	98	45	96	41	156	62	193	185
Diseases of the coronary arteries and angina pectoris		3,594		—		—		—		200		1,478		1,930		2,143
Diseases of the respiratory system	84	42	98	30	84	9	81	15	88	24	82	19	83	40	95	36
Bronchitis	76	40	113	6	59	5	33	21	27	77	31	41	62	42	93	28
Pneumonia (all forms)	111	42	90	54	99	11	106	15	141	18	156	12	184	30	192	59
Diseases of the digestive system	77	41	130	22	80	12	76	32	66	40	52	46	57	53	53	52
Ulcer of the stomach		284		44		—		—		36		95		208		323
Diarrhoea and enteritis	79	18	128	22	74	7	31	10	26	25	43	20	44	10	36	10
Appendicitis		59		33		172		42		38		41		74		152
Cirrhosis of the liver		20		133		—		50		—		10		11		—
Non-venereal diseases of the genito-urinary system and annexa	183	102	366	60	141	28	115	42	109	66	127	37	214	37	181	80
Nephritis	403	67	809	22	231	17	190	35	184	71	209	36	454	31	754	—
Suicide	251	87	—	—	—	—	200	50	238	84	249	51	230	57	223	86
Other violence	62	74	120	55	66	46	43	103	49	99	56	58	70	50	83	80
Accidental burns	45	23	100	28	64	13	31	25	16	30	25	25	43	35	78	72
Rail, road and *air transport accidents*		140		31		151	—	199		211		107		85		123
Developmental and wasting diseases (under 1)	—	—	105	38	—	—	—	—	—	—	—	—	—	—	—	—
Prematurity	—	—	116	42	—	—	—	—	—	—	—	—	—	—	—	—



[1] Based on 'selection by rules'.

[2] Based on selection by certifying medical practitioners' preference.

Fig. 2. Proportionate distribution of causes of death per 1000 deaths from all causes, by age; England and Wales, 1848–72 and 1947.

APPENDIX 3. *Death rates from certain causes by sex and age.*

A. Absolute death rates in 1901–10 percent of rates in 1848–72.
B. Absolute death rates in 1947 (selection by rules) percent of rates in 1901–10.

Females	All ages		Under 1		1–4		5–14		15–24		25–44		45–64		65+	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
All causes	**67**	**78**	**82**	**28**	**51**	**11**	**44**	**23**	**41**	**48**	**55**	**39**	**85**	**52**	**91**	**78**
Infectious diseases	37	24	108	6	20	20	33	15	29	58	35	35	43	25	66	28
Typhoid and paratyphoid		1		—		—		1		0		1		—		—
Typhus	0	—	—	—	0	—	0	—	0	—	0	—	0	—	0	—
Smallpox	4	2	3	—	2	—	3	—	4	—	11	1	16	3	27	17
Measles	72	5	114	10	84	5	64	10	36	50	43	3	50	100	100	100
Scarlet fever	8	1	5	1	9	1	10	2	13	5	14	1	5	10	2	40
Whooping cough	54	8	81	12	58	8	43	15	50	—	60	33	80	—	200	20
Diphtheria		3		6		3		5		13		13		14		17
Influenza	299	39	95	55	121	39	264	24	511	26	647	15	460	20	272	24
Cholera	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dysentery	10	29	7	36	4	—	8	40	7	30	15	20	14	15	12	14
Respiratory tuberculosis	37	38	21	25	30	22	35	15	30	66	36	38	44	22	54	31
Other tuberculosis	66	17	61	4	59	16	98	23	129	48	152	29	116	29	111	28
Syphilis	75	28	100	8	79	—	200	10	24	40	59	26	141	88	250	173
Cancer	214	177	109	188	176	167	175	121	132	124	130	91	186	87	276	121
Diabetes mellitus	500	174	50	200	300	33	250	27	238	32	243	32	567	71	1,236	173
Anaemia		109		48		18		70		17		19		45		218
Diseases of the nervous system and sensory organs	68	67	48	7	47	9	58	18	51	34	66	37	95	42	104	58
Cerebral haemorrhage, apoplexy, etc.	89	110	8	103	7	18	13	14	18	25	43	29	89	40	96	66
Infantile convulsions (under 5)	—	—	42	2	25	4	—	—	—	—	—	—	—	—	—	—
Diseases of the circulatory system	117	281	16	24	25	14	85	14	77	37	80	48	109	75	139	231
Heart diseases (excluding diseases of the coronary arteries and angina pectoris)	164	206	46	10	85	10	118	14	97	35	104	42	147	48	207	178
Diseases of the coronary arteries and angina pectoris		3,469		—		—		—		100		550		1,279		2,328
Diseases of the respiratory system	84	32	100	30	80	8	75	17	63	26	71	22	74	18	106	25
Bronchitis	80	22	116	7	59	4	34	32	23	40	33	25	60	12	102	16
Pneumonia (all forms)	106	42	93	55	93	10	100	15	107	19	156	15	192	25	220	55
Diseases of the digestive system	72	32	131	20	75	8	76	28	63	22	49	24	53	29	54	41
Ulcer of the stomach		57		83		—		8		2		7		58		194
Diarrhoea and enteritis	72	16	127	20	70	5	37	6	22	33	29	29	38	16	37	12
Appendicitis		62		40		156		49		26		34		70		145
Cirrhosis of the liver		14		—		—		50		—		8		—		12
Non-venereal diseases of the genito-urinary system and annexa	330	70	417	47	205	17	181	43	181	56	252	35	353	34	424	61
Nephritis	503	71	910	17	297	14	248	38	238	60	311	35	568	33	895	63
Diseases of pregnancy, childbirth and the puerperal state	97	20	—	—	—	—	180	—	93	30	91	20	47	13	—	—
Puerperal sepsis	84	9	—	—	—	—	150	—	67	9	83	9	63	4	—	—
Suicide	223	159	—	—	—	—	100	—	211	55	244	109	198	134	149	196
Other violence	79	93	124	49	73	37	58	75	56	94	76	65	89	60	103	110
Accidental burns	63	30	97	28	74	15	55	18	67	14	79	16	98	27	60	70
Rail, road and air transport accidents		260		133		127		322		457		267		200		217
Developmental and wasting diseases (under 1)	—	—	101	38	—	—	—	—	—	—	—	—	—	—	—	—
Prematurity	—	—	117	42	—	—	—	—	—	—	—	—	—	—	—	—

SOURCES OF THE STATISTICAL DATA USED

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ILLNESS, INCAPACITY, AND MEDICAL ATTENTION AMONG ADULTS, 1947–49

W. P. D. LOGAN
M.D., B.Sc. Glasg., D.P.H.
MEDICAL STATISTICIAN, GENERAL REGISTER OFFICE

THE number of times that people are ill, the length of their illnesses, and how often they consult their doctor are matters of some concern to the medical profession. The purpose here is to compare the prevalence of illness among adults, the duration of incapacity, and the frequency of consultations between patients and doctors during the twelve months from July, 1948, to June, 1949, and the previous twelve months from July, 1947, to June, 1948.

The information has been obtained from the continuous Survey of Sickness carried out on behalf of the Registrar-General. Each month trained interviewers of the Government Social Survey visit a different sample of some 4000 persons, aged 16 and over, living in various parts of England and Wales, the samples being so selected as to represent the whole adult population. The selected individuals are asked about their health during the two previous months, the illnesses and injuries they suffered, how long they were kept off work or prevented from going out of doors, and how often they consulted a doctor. After tabulation at the General Register Office the results of the interviews are published in the Registrar-General's Quarterly Returns.[1] The return for the first quarter of 1949 (no. 401) included a note on the prevalence of sickness, incapacity, and medical consultations during July–December, 1948, compared with corresponding months in the two previous years. Descriptions of the methods used in the Survey of Sickness since it began in October, 1943, and of some

1. Quarterly Returns of the Registrar-General: nos. 393–403, tables A–H; no. 401, p. 29. H.M. Stationery Office.

differ from those of females, and rates for the young differ from those for the old. To compare the death

of the results have been given by Stocks,[2] Box and Thomas,[3] and Slater,[4] in Ministry of Health reports,[5] and in the *Monthly Bulletin of the Ministry of Health*.[6] The fullest report on results is that by Stocks,[7] who proposed definitions for morbidity statistics, studied the effect on recorded sickness of such factors as memory, sex, age, and season, and compared the prevalence of a few important diseases, as indicated independently by the survey and by special food allowance statistics

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TABLE I—MEAN MONTHLY SICKNESS, PREVALENCE, INCAPACITY, AND MEDICAL CONSULTATION RATES PER 100 PERSONS INTERVIEWED : JULY–JUNE, 1947–48 AND 1948–49

—	Male		Female		Persons
	16–64 years	65 years and over	16–64 years	65 years and over	16 years and over
Sickness-rates :					
1947–48	58	76	68	85	66
1948–49	61	79	72	87	69
Percentage difference	+6	+4	+6	+3	+5
Prevalence-rates :					
1947–48	105	166	150	218	139
1948–49	115	175	164	230	151
Percentage difference	+9	+5	+9	+5	+8
Incapacity-rates :					
1947–48	89	148	72	159	90
1948–49	96	162	94	223	110
Percentage difference	+8	+9	+32	+41	+22
Medical consultation rates :					
1947–48	35	60	38	57	40
1948–49	37	65	45	69	45
Percentage difference	+6	+9	+18	+22	+13

TABLE II—MEAN MONTHLY SICKNESS, PREVALENCE, INCAPACITY, AND MEDICAL CONSULTATION RATES PER 100 PERSONS INTERVIEWED: JULY–JUNE 1946–47 AND 1948–49

—	Male		Female		Persons
	16–64 years	65 years and over	16–64 years	65 years and over	16 years and over
Sickness-rates:					
1946–47	60	78	70	86	68
1948–49	61	79	72	87	69
Percentage difference	+1	+1	+3	+1	+2
Prevalence-rates:					
1946–47	113	170	155	224	145
1948–49	115	175	164	230	151
Percentage difference	+2	+3	+5	+3	+4
Incapacity-rates:					
1946–47	107	153	89	157	105
1948–49	96	162	94	223	110
Percentage difference	−10	+6	+6	+42	+5
Medical consultation rates:					
1946–47	37	59	40	65	42
1948–49	37	65	45	69	45
Percentage difference	..	+9	+13	+7	+8

(derived from form R.G. 50) and found these two sources to be in close agreement.

DEFINITIONS

Here the periods 1947–48 and 1948–49 are the twelve-month periods from July, 1947, to June, 1948, and from July, 1948, to June, 1949, the latter period being of course the first twelve months of the National Health Service. Tables II and IV, however, also include periods from July, 1946, onwards. The rates in the tables are mean monthly rates—that is, they refer to the average monthly experience of the periods stated. It must be emphasised that the records relate only to persons aged 16 years and over.

In general morbidity studies it is essential to distinguish between the number of persons ill and the number of illnesses reported, because patients are liable to suffer from more than one illness or injury in a month. Sickness-rates are defined as the number of persons

per 100 interviewed who report at least one illness or injury during the month. It follows that each person can contribute no more than one unit to the sickness-rate for the month, and that the rate can never exceed 100. Prevalence-rates, on the other hand, are defined as the total number of illnesses and injuries reported per 100 persons interviewed, whether these occur simultaneously or consecutively during the month; and theoretically there is no limit to the number of illnesses that may be reported. Incapacity-rates are the number of days away from work on account of illness during the month per 100 persons interviewed; or, for persons not going out to work, the number of days on which they were prevented by illness from going out of doors. Medical consultation rates are the number of visits during the month made to, or by, a doctor (including medically qualified ophthalmic or other specialists,

TABLE III—MEAN MONTHLY SICKNESS, PREVALENCE, INCAPACITY, AND MEDICAL CONSULTATION RATES PER 100 PERSONS INTERVIEWED, BY SEX AND AGE: JULY–JUNE 1947–48 AND 1948–49

—	Age (years)							All ages
	16 –	25 –	35 –	45 –	55 –	65 –	75 +	
Sickness-rates:								
Male—1947–48 ..	48	54	57	63	66	74	81	60
1948–49 ..	52	59	60	65	70	76	85	63
Female—1947–48 ..	56	64	69	74	77	83	88	70
1948–49 ..	61	68	73	77	82	86	89	74
Prevalence-rates:								
Male—1947–48 ..	80	94	103	120	128	157	186	113
1948–49 ..	87	106	111	126	147	165	197	123
Female—1947–48 ..	106	133	153	174	187	211	234	160
1948–49 ..	121	142	165	187	209	226	239	174
Incapacity-rates:								
Male—1947–48 ..	71	70	82	105	126	135	180	97
1948–49 ..	64	77	82	108	166	144	206	105
Female—1947–48 ..	67	65	61	77	96	132	212	85
1948–49 ..	78	77	80	112	136	198	274	114
Medical consultation rates:								
Male—1947–48 ..	27	30	34	40	46	57	65	38
1948–49 ..	26	34	34	42	52	61	73	41
Female—1947–48 ..	30	33	36	46	48	52	67	41
1948–49 ..	35	38	41	56	59	63	82	49

TABLE IV—MEAN MONTHLY SICKNESS, PREVALENCE, INCAPACITY, AND MEDICAL CONSULTATION RATES PER 100 PERSONS AGED 16 AND OVER, BY QUARTERS: JULY, 1946, TO JUNE, 1949

Quarter		Sickness	Prevalence	Incapacity	Medical consultations
1946:	July–Sept. ..	67	143	72	38
	Oct.–Dec. ..	72	159	102	44
1947:	Jan.–March ..	70	147	158	47
	April–June ..	64	132	84	38
	July–Sept. ..	62	129	65	35
	Oct.–Dec. ..	70	149	100	41
1948:	Jan.–March ..	67	143	114	44
	April–June ..	64	135	82	39
	July–Sept. ..	64	135	84	38
	Oct.–Dec. ..	71	153	126	46
1949:	Jan.–March ..	73	163	136	52
	April–June ..	68	147	90	43

but excluding dentistry and attention whilst an inpatient in a hospital) per 100 persons interviewed.

RESULTS

In 1948–49 the number of people, aged 16 and over, who complained of illness (the sickness-rate) increased by 5%, and the number of illnesses increased by 8%, compared with 1947–48 (table 1). The increases were greater among those aged under 65 than among older people. The number of days away from work or confined to the house (the incapacity-rate) increased by 22%, but there was a great difference between men and women. Younger men showed an increase of 8% and older men of 9%. Younger women, on the other hand, reported 32% more days of incapacity and older women 41% more—increases that are far beyond what would be expected from the additional illness that they suffered.

Medical consultation rates increased by 13%. This is a measure of the average increase, over the whole country, in the number of consultations between *adult* patients and doctors during 1948–49, compared with 1947–48. In many practices the increase was no doubt well above this average figure, but in others it would be

much less, depending largely, as will be seen, upon the proportion of women patients in the practice, and their age and general income level. The average increases for men were 6% for those under 65, and 9% for those aged 65 and over. For women the increases were much greater—18% among the younger and 22% among the older women. There can be little doubt that before the start of the new National Health Service many women—especially, but not exclusively, elderly women—were deterred from seeking medical advice by economic reasons. Now that the financial barrier has been removed, women, who, as the records show, complain of illness considerably more often than men, are able to consult their doctor more often than they did before.

It seems likely that the increased number of days of incapacity reported by women has been a direct consequence of more frequent medical attention. Since July, 1948, some of the women who have seen their doctor about complaints that they would previously have neglected or treated themselves have been ordered to bed or advised to stay indoors until they recovered. Among men, both young and old, the increase in incapacity and in medical consultations was no more than would result from their slightly increased rates of illness.

There are certain dangers in comparing the experience of one twelve-month period with only the previous

TABLE V—PERCENTAGE DISTRIBUTION OF PERSONS INTERVIEWED BY DAYS OF INCAPACITY PER MONTH: JULY–JUNE, 1947–48, AND 1948–49

—	No. of days of incapacity									
	Male					Female				
	0	1–3	4–10	11 +	Total	0	1–3	4–10	11 +	Total
Aged 16–64 years:										
1947–48	92·0	2·5	2·5	3·0	100	92·6	2·6	2·5	2·3	100
1948–49	91·2	2·8	2·7	3·3	100	90·7	2·9	3·2	3·2	100
Aged 65 years and over:										
1947–48	90·1	1·8	3·1	5·0	100	90·1	1·4	3·1	5·4	100
1948–49	88·7	2·1	3·7	5·5	100	86·8	1·7	3·5	8·0	100

TABLE VI—PERCENTAGE DISTRIBUTION OF PERSONS INTERVIEWED BY NUMBER OF MEDICAL CONSULTATIONS PER MONTH: JULY–JUNE, 1947–48, AND 1948–49

—	No. of medical consultations									
	Male					Female				
	0	1	2	3+	Total	0	1	2	3+	Total
Aged 16–64 years:										
1947–48	87·5	5·0	3·1	4·4	100	85·4	6·2	3·5	4·9	100
1948–49	86·1	5·9	3·1	4·9	100	81·8	8·4	4·2	5·6	100
Aged 65 years and over:										
1947–48	78·7	9·4	4·6	7·3	100	77·7	9·9	5·8	6·6	100
1948–49	75·9	10·2	5·9	8·0	100	73·0	12·0	6·5	8·5	100

twelve months, and it would be more satisfactory to make comparisons with similar periods over a number of previous years. Unfortunately the tabulations of the Survey of Sickness, in their present form, go back only as far as July, 1946 (and have been published only since October, 1946), so that no more than one additional twelve-month period can be studied—from July, 1946, to June, 1947. Table II compares rates for this period with those for 1948–49; and from this table, in conjunction with table I, it can be seen that the increases in 1948–49 compared with 1946–47 were smaller than those for 1948–49 compared with 1947–48, especially with regard to incapacity. It will be recalled, however, that the winter of 1946–47 included a protracted period of exceptionally cold weather—the coldest in fifty years or more—and during that time sickness, consultation and, most of all, incapacity rates were very high. The period July, 1946, to June, 1947, fails, therefore, to provide an altogether satisfactory gauge against which to set subsequent experience.

In addition to weather, a further factor to be noted is the presence or absence of epidemic influenza. There was a moderate amount of influenza in the winter of 1946–47, practically none in 1947–48, and quite a

TABLE VII—PERCENTAGE DISTRIBUTION OF ILLNESSES BY CATEGORY OF SEVERITY (SEXES COMBINED): JULY–JUNE, 1947–48 AND 1948–49

—	Serious	Moderate or mild	Minor	Ill-defined	Total
Aged 16–64 years:					
1947–48	2·2	5·4	70·8	21·6	100
1948–49	2·3	6·0	65·1	26·6	100
Aged 65 and over:					
1947–48	12·1	4·5	67·6	15·8	100
1948–49	11·4	5·2	63·3	20·1	100

severe epidemic in 1948–49 between February and April, 1949. This epidemic was responsible for some of the increased incidence of sickness, incapacity, and medical consultations during the last period.

Table III gives rates for the two twelve-month periods 1947–48 and 1948–49 with greater detail of age. A noteworthy feature about these rates is the tendency for practically all of them to increase uniformly with advancing age. Probably the only real exception is in the incapacity indices among women where the rate at ages 16–24 was higher than at ages 25–34. The reason presumably is that there are many more housewives in the older age-group, and housewives are a class of women who are less readily incapacitated for their work by illness than younger women in other occupations.

Table IV gives monthly rates for all adults by separate quarters from July, 1946. More detailed rates by sex, age, and single months have been given in the Registrar-General's Quarterly Returns nos. 401 (with special note), 402, and 403 (table A). The highest sickness, prevalence, and medical consultation rates, and the second highest incapacity-rate for any quarter were recorded in January to March, 1949, during the influenza epidemic.

Tables V and VI show the proportions of people who had different numbers of days of incapacity and medical consultations per month. In each sex-age group the proportion with no days of incapacity and the proportion with no medical consultations decreased, the reduction being greater among women than men, and greater among

the elderly than among younger adults. The greatest relative increases in days of incapacity were among the proportions who had 4–10 days and 11 or more days of incapacity. For medical consultations the proportions having 1, 2, and 3 or more consultations all increased, but the increase was greatest among those women aged 16–64 who saw their doctor once in the month.

The number of illnesses reported by all adults increased by 8% (table I). It may be asked whether this was an increase in illness of all grades of severity, or whether it consisted predominantly of minor and relatively trivial conditions. Table VII supplies the answer, showing that though there was an increase in "ill-defined" illness this was at the expense of "minor" illness. Thus there was no great redistribution in the severity of reported illness, and there is nothing to

TABLE VIII—MEAN MONTHLY SICKNESS, PREVALENCE, INCAPACITY, AND MEDICAL CONSULTATION RATES PER 100 PERSONS AGED 16 YEARS AND OVER, BY OCCUPATIONAL GROUPS: JULY–JUNE, 1947–48 AND 1948–49

—	Professional, managerial, and clerical		Operatives and other grades		Retired, part-time, unoccupied or unstated		Housewives
	M	F	M	F	M	F	F
Sickness-rates:							
1947–48	56	58	58	62	79	78	73
1948–49	59	61	61	66	82	82	77
Percentage difference	+5	+5	+5	+6	+4	+5	+5
Prevalence-rates:							
1947–48	98	116	104	126	178	191	170
1948–49	110	118	113	142	189	203	185
Percentage difference	+12	+2	+9	+13	+6	+6	+9
Incapacity-rates:							
1947–48	49	70	87	79	212	184	73
1948–49	61	78	86	96	266	267	102
Percentage difference	+24	+11	−1	+22	+25	+45	+40
Medical consultation rates:							
1947–48	29	34	32	31	80	64	41
1948–49	31	33	34	38	89	81	49
Percentage difference	+7	−3	+6	+23	+11	+27	+20

suggest that the increase has been due to illness of a trivial nature.

Tables VIII and IX analyse the results by occupation and by income; but to avoid having very small numbers in the different classes, only very wide occupational and income groupings have been made. Table VIII presents rates for four large occupational groups (distinguishing men from women): (*a*) professional, managerial, and clerical occupations; (*b*) operatives and other grades, including persons engaged in manufacturing, transport and public services, mining and quarrying, building, agriculture and fishing, distribution, and other specified employment; (*c*) retired, part-time, and unoccupied persons and those whose occupation was not stated; and (*d*) housewives. To

TABLE IX—MEAN MONTHLY SICKNESS, PREVALENCE, INCAPACITY, AND MEDICAL CONSULTATION RATES PER 100 PERSONS AGED 16 YEARS AND OVER, BY WEEKLY INCOME OF CHIEF WAGE-EARNER OF THE FAMILY: JULY–JUNE, 1947–48 AND 1948–49

—	Under £3		£3–£4		£4–£5 10*s.*		£5 10*s.*–£10		£10 and over	
	M	F	M	F	M	F	M	F	M	F
Sickness-rates:										
1947–48 ..	81	81	64	70	60	69	56	68	60	67
1948–49 ..	82	83	69	74	62	74	62	73	60	72
Percentage difference ..	+1	+2	+8	+6	+3	+7	+11	+7	..	+7
Prevalence-rates:										
1947–48 ..	189	207	127	159	109	154	101	149	111	149
1948–49 ..	197	217	145	173	118	170	114	165	115	159
Percentage difference ..	+4	+5	+14	+9	+8	+13	+14	+11	+4	+7
Incapacity-rates:										
1947–48 ..	193	130	105	93	104	76	78	74	52	82
1948–49 ..	262	180	129	112	105	113	85	96	67	90
Percentage difference ..	+36	+38	+23	+20	+1	+49	+9	+30	+29	+10
Medical consultation rates:										
1947–48 ..	79	52	39	37	37	38	32	40	38	49
1948–49 ..	88	63	55	52	40	46	33	46	35	46
Percentage difference ..	+11	+21	+41	+41	+8	+21	+3	+15	−8	−6

some extent the experiences of the different occupational groups depend upon their age structure, but it has not been possible to make any adjustment for this. The high rates in the group of retired and other persons arise from this cause. Housewives, it will be observed, had high sickness, prevalence, and medical consultation rates compared with women in other occupations. Their incapacity-rate in 1947–48 was not proportionately high, but it underwent an increase of 40% in the next twelve months. By contrast, there was a reduction of 1% in incapacity among men in the group of miscellaneous trades. Medical consultations for women in professional, managerial, and clerical occupations diminished by 3%, while those for women in miscellaneous employment increased by 23% and for housewives by 20%.

Table IX gives separate rates according to the income of the chief wage-earner of the family. Again no adjustment has been made for age differences between the income groups. For this reason rates are very high in the under-£3 group, which contains a large proportion of elderly pensioners. In both sexes there is a general tendency for illness to decline as income rises. The increase in the sickness and prevalence rates in 1948–49 compared with 1947–48 was not concentrated at any particular income level, and there was little difference between men and women. More days of incapacity were reported at every income level but in the groups from £4 up to £10 the increase among women was much greater than among men. Medical consultations also increased unequally in the two sexes at incomes under £3 and from £4 to £10. The greatest increase in consultations was at £3–4—a 41% rise for men and for women. Standing out in very sharp contrast, men and women in the group with incomes of £10 and over saw their doctor *less* often after July, 1948, than in the previous twelve months, despite a slight increase in illness. That section of the population who could best afford to pay for medical attention under the old system appear to have taken least advantage of the new ; whilst people with more limited incomes, especially women, who formerly saw their doctor less often than they should have done—or at any rate less often than those with

more money—have found it possible since July, 1948, to have medical attention more in keeping with the amount of illness of which they complain.

SUMMARY

A study of the results of the Survey of Sickness for the twelve-month period July, 1948, to June, 1949, compared with the previous twelve months, has shown that 5% more adults aged 16 and over had some illness, and that the number of individual illnesses increased by 8%. The number of days of incapacity (days away from work or kept indoors on account of illness) increased by 22%, and the number of consultations with doctors increased by 13%.

The increase in incapacity and in medical consultations was greater among women than men and greater among elderly than young adults.

Persons whose chief wage-earner had a small income, especially women, formerly had less frequent medical attention than those who could better afford to pay for it. Since July, 1948, the number of medical consultations among those in the small-income groups has greatly increased, but among those with large incomes they have become less.

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MEDICAL SIGNIFICANCE OF THE CENSUS

BY

W. P. D. LOGAN, M.D., B.Sc., D.P.H.
Medical Statistician, General Register Office

Although Moses, Joshua, Saul, Solomon, and Jehoram each succeeded uneventfully in numbering some or all of the people of Israel, King David was less fortunate, and his Satan-inspired venture in 1017 B.C. provoked Divine wrath and drew on Israel a three-day pestilence, "and there died of the people from Dan even to Beer-sheba seventy thousand men."[1]

Credit is claimed by Canada for the first census of modern times, a census of the Colony of New France in 1666.[2] The first complete census of a European country was held in Iceland in 1703,[3] followed by Sweden in 1749.[4] After a considerable amount of religious opposition had finally been overcome the first census in England was held in 1801. Since then there has been a census in this country every 10 years, with the exception of 1941. Despite the forebodings of our eighteenth-century legislators, no pestilences have resulted that can be attributed to these enumerations. On the contrary, by its contributions towards knowledge of the numbers of people and of the conditions under which they live, the census has played an important part in the prevention of disease.

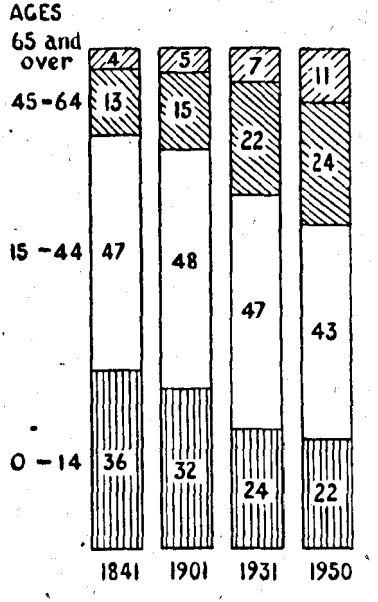
Death and Sickness Rates

The first contribution that the census makes to workers in the medical field is to provide denominators for the various arithmetic indices—the sanitary indices—that measure the state of the public health. Often it is not enough to know the number of cases of illness or of deaths occurring in a community unless the number at risk is also known—usually the number of persons living in the community at the given time. This is not all, however; of almost equal importance to knowing the total numbers at risk is to know their sex and age distribution. Sickness and death rates of males differ from those of females, and rates for the young differ from those for the old. To compare the death

rates, say in two towns, it is necessary to use some method of standardization to make allowance for sex and age differences in the two populations, and for this to be done it is necessary to know what these sex and age differences are.

Similarly, comparison of death rates between one year and another must involve some form of standardization if fallacious conclusions about the trends of health and sickness are to be avoided. It is well known that the population of this country has been ageing for some time past—that is to say, the proportion of young persons has been becoming less and the proportion of old persons more. This change has been the result partly of a more or less progressive fall in birth rates during the course of this century and partly because people live, on the average, several years longer now than ever before. Since old people, whatever their state of health, are normally more liable to die than young people, it follows that the more old people there are in the population the higher will be the crude—that is, unstandardized — death rate. As a result the crude death rate for England and Wales, which averaged 23.3 per 1,000 per annum in 1846–50 and had fallen to 12.1 by 1921–5, was still 11.8 in 1949. This does not indicate a slowing down of improvement in the nation's health, but just the opposite. When allowance is made for ageing of the population, the death rate in 1949 is found to have fallen by almost 30% compared with 1921–5.

The accompanying Chart shows the proportions of the population at



Proportionate distribution of the population of England and Wales at ages 0–14, 15–44, 45–64, and 65 and over in 1841, 1901, 1931, and 1950. (The percentage of persons at each age is indicated within the Chart.)

different ages as revealed by the censuses of 1841, 1901, and 1931, and the estimated proportions in 1950. This year's census will show whether or not the estimates of proportions for 1950 have been good ones.

Since sickness rates as well as death rates tend to increase with advancing age,[5 6] it must also be expected that in an ageing population the crude sickness rate may be slow to fall or may even tend to increase despite a real improvement in health.

Life Tables and Expectation of Life

A further purpose that is served by accurate census information on the sex and age composition of the population is the construction of national life tables, and hence the calculation of the expectation of life. Although there are no longer the vigorous discussions on life-table principles and techniques that were a feature at gatherings of vital statisticians early this century, life tables still have important uses and will continue to be constructed. Early attempts to build up life tables, such as Halley's, could not be fully successful, since details of the population by sex and age were not known, and it has only been since the introduction of the census that life tables have been constructed accurately.

The expectation of life—that is, the average number of years that will be lived by a group of persons of given age subject to given mortality experience—is derived from the life table. The expectation of life in England and Wales has progressively increased according to the successive English Life Tables calculated after each census. Thus expectation of life at birth increased for males from 40 years in 1841 to 59 years in 1931, and for females from 42 to 63 years. *Approximate* expectations of life in 1949 were 66 years for males and 70.6 years for females.

Occupational Mortality

Among the most useful medical statistical studies that have been made in this country are the series of analyses of mortality in relation to occupation and social class, described by Greenwood as "the most valuable single instrument of socio-medical research our national armoury contains."[7] The twin bases of these occupational mortality analyses are: (1) the occupations of deceased persons as stated at the registration of death;

and (2) the occupations of the living as stated on the census schedules. These analyses can be made only in and near the years when census information on the occupations of the living is available to provide denominators for the numbers of deaths. The pioneer work in this field has been done in this country, where occupational mortality analyses have been made in relation to each census from 1851. In the two most recent analyses, dealing with deaths in the periods 1921–3[8] and 1930–2,[9] the various occupations were grouped into a number of Social Classes—viz., I, Professional and Managerial; II, Intermediate between I and III; III, Skilled workers; IV, Intermediate between III and V; and V, Unskilled workers. Relative mortality of men in these Social Classes in 1921–3 and 1930–2 is shown in Table I, allowance being made for differences in the age structure of the groups.

TABLE I

	Social Classes					All Males Aged 20–65
	I	II	III	IV	V	
1921–3 ..	82	93	94	99	124	100
1930–2 ..	90	94	97	102	111	100

It will be interesting to see whether the analysis for 1950–2 will show further narrowing of the gap between Social Classes I and V.

In 1930–2 the occupation with the highest mortality of males was that of tin- and copper-mine workers below ground, with a mortality experience 242% above the average for all males. Medical practitioners had mortality rates 6% and coal-miners (all men engaged in coal-mining) 7% above the general average.

Deaths of males from angina pectoris and coronary disease showed a strong social class gradient in 1930–2 (Table II).

TABLE II

Social Classes					All Males Aged 35–65
I	II	III	IV	V	
237	148	95	66	67	100

Since 1930–2 the recorded mortality from coronary disease has increased tremendously, and when the deaths during 1950–2 can be tabulated it will be of considerable

interest to learn whether the excess of mortality in the professional occupations still persists.

Deaths of married women during 1930–2 were analysed by occupation of husband. Since husbands and wives in general share the same socio-economic environment but differ in respect of occupation, it was thus possible to distinguish the adverse effects of socio-economic from occupational factors. It is intended to repeat this type of analysis with deaths during 1950–2.

Attention will also be paid once again to variations in infant mortality in relation to the father's occupation and social class. Previous analyses of this have revealed considerable disparity between the social classes. Table III shows the relative rates of mortality of legitimate infants dying under 1 year of age in 1921–3 and 1930–2.

TABLE III

	Social Class					All Classes
	I	II	III	IV	V	
1921–3 ..	48	70	97	113	123	100
1930–2 ..	53	73	94	108	125	100

Enumeration of Infirmities

At each of the English censuses during 1851–1911 questions were asked for the purpose of ascertaining the number of persons blind or deaf and dumb. In the absence previously of authentic information about their numbers, great disadvantages were said to have resulted "to those afflicted persons on whose behalf the appeals and efforts of philanthropy, unsupported by a reference to facts illustrative of their numbers and condition, have lost much of their intended effect."[10]

In 1851 one person in every 979 was returned as blind, and, according to Farr,[11] one of the most prolific causes of blindness in England was smallpox, which was responsible for more than one-sixth of the cases. At each census from 1871 to 1911 information was also obtained about the number of persons lunatic, imbecile, or feeble-minded. Questions about infirmities were not asked at the censuses of 1921 and 1931, since it had come to be recognized that the information elicited was unreliable.

Enumeration of the Sick

No attempt has been made at the English censuses to obtain direct information about prevalence of disease,

but a notable incursion into this difficult and unexplored field was made at the census of Ireland in 1851. In the words of the Census Commissioners: "In making arrangements for taking the census the subject of the diseases of the living occupied our attention, and preparations were accordingly made for procuring returns of all those persons who laboured under disease either at their homes or in public institutions upon the night of March 30, 1851."[12a] The purpose of the inquiry was thus described on the Sick Returns (schedules) that were used: "The alleviation of human suffering arising from bodily infirmity is a work in which every member of the community should naturally feel an interest; and one important step in this direction is to ascertain the extent and character of the evils to be contended with; towards these most desirable objects the Commissioners hope to assist by means of this Return."[12b]

The results of this pioneer inquiry, published in a volume entitled *Report on the Status of Disease*, might not, by modern standards, be regarded as giving very sound evidence upon the prevalence of disease; nevertheless the inquiry was not without value, and was repeated at each census of Ireland until 1911. Out of a total population of some 6½ million persons, 104,000, or 1 in 62½, were returned as "labouring under disease" on the chosen night; 9,000 of these in hospitals, asylums, and gaols, 47,000 in workhouses, and 48,000 in their own homes. One-third of the sick were returned as suffering from an infectious disease, one-quarter from disease of the nervous system, and one-tenth from respiratory disease including consumption. Circulatory disease was infrequent, afflicting only 0.5% of those sick. Coronary disease, of course, was not mentioned, but the following passage in connexion with the 266 cases of heart disease (out of over 6 million persons) reported by people in their own homes contains matter for pondering upon: "As, however, a diagnosis of cardiac affection could not well be made except by professional persons, and as the peasantry of Ireland popularly term several other affections chiefly of dyspeptic character 'diseases of the heart,' *from the distress experienced being, for the most part, referred to the precordial region*, we think it likely that the number returned as labouring under disease of the heart at their own homes is somewhat exaggerated."[12c]

Apart from blindness, deaf-mutism, and mental impairment, no attempt has been made at the censuses of England and Wales to ascertain the prevalence of

disease, but, as has been emphasized earlier, the census enumeration of the population has been a necessity in order that the prevalence of disease, as determined by other methods, can be meaningfully related to the numbers at risk. The census, however, is more than an enumeration of the people by sex, age, and occupation. It is a periodic social survey embracing every individual in the country, determining not only the number but also the condition of the people in relation to their social environment, their homes, and their families. As such it not only provides the means for recording the results of medical progress in the past but also points out some of the directions in which further efforts are needed to achieve still greater progress in the future.

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OF THE

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AND THE

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Directed by the

MEDICAL RESEARCH COUNCIL

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SECTION I.—GENERAL

Issued from the Office of the
Ministry of Health, Whitehall, S.W.1.

THE RECENT TREND OF DIPHTHERIA IN ENGLAND AND WALES

W. J. MARTIN, The Medical Research Council's Statistical Research Unit,
London School of Hygiene and Tropical Medicine

The mortality rates from diphtheria in England and Wales had fallen considerably before the introduction of immunisation on a wide scale, from, for example, 888 per 1,000,000 children aged under 15 in 1901 to 301 in 1938. The annual case rate had, however, fluctuated considerably and had shown a tendency to increase slightly during the twenty years preceding the last war, the rate varying during 1911-37 between 105 per 100,000 persons in 1923 and 184 in 1930. In London the number of bacteriological cases included in these returns had steadily increased since 1922 and a similar tendency in the whole country may have accounted for the apparent increase. Although the mortality had decreased considerably the trend of the disease was unsatisfactory since the fundamental biological facts of the aetiology of diphtheria had been established for years.

The success attending the practice of active immunisation in American and Canadian cities led the Government to offer a prophylactic free to all local authorities in 1940. This offer met with varying success within the country but for the whole country it was estimated that not quite one half of the child population had been immunised by 1942. As the response began to wane another campaign was started with the object of increasing the percentage of immunised children to at least 75.

The concurrent reduction in the mortality from diphtheria cannot be attributed solely to immunisation for some of the fall must be credited to the continued operation of the factors (improvements in treatment, hygiene, etc.) which were causing the death rate to decline between the beginning of the century and 1938. To obtain some assessment of the additional improvement caused by immunisation a simple exponential curve was fitted to the death rates per 1,000,000 children aged under 15 during the period 1901-38 and the extrapolated values for 1939-46 were found. These rates are:—

Year	Death Rates: Extrapolated values	Death Rates: Observed values
1939	247	228
1940	241	266
1941	235	280
1942	230	192
1943	224	134
1944	219	92
1945	214	67
1946	209	40

The mortality in 1946 was, therefore, less than one fifth of what would have been expected if the death rate had continued to fall at the same rate as was operating before mass immunisation was introduced.

The table shows that a considerable shift took place in the age distribution between 1944 and 1947. The pre-school child and the adult were in 1947, *relatively*, more often attacked than in 1944, for the notifications in these two extreme age groups formed 39 per cent. of all notifications in the later year and 29.9 per cent. in the earlier year. The greatest fall in the attack rate was among children aged 10-15, at which ages the rate in 1947 was only one-fifth of that in 1944. The *relative* increase in the liability of the pre-school child to contract diphtheria is in direct contrast to the experience of the preceding decades. Early in the present century a gradual shift in the age of attack commenced and during the following 30 years the death rate at ages under 5 decreased more rapidly than at ages 5-9 with the result that the disease became relatively more concentrated on children of school age. Immunisation has apparently reversed this trend and diphtheria has become relatively more important among the pre-school child.

The sex ratio of diphtheria notifications has also been modified during the past four years. A relatively greater decline has occurred in the female incidence than in the male, although the characteristic feature of a much higher attack rate in adult females is still well marked. The greatest relative decline in the sex ratio was at ages 25 and over. This age group had the largest ratio in 1944 and 1945 but during the four years the ratio was almost halved. As a consequence of this trend the largest sex ratio, during 1946 and 1947, was that of ages 15-24. At ages 10-15 the females have shown a *relative* increase, during the four years, in their greater liability to attack by diphtheria.

Conclusions

The trend of diphtheria since immunisation was introduced on a large scale shows that although much has been accomplished, there are still large numbers of children who have no immunity to diphtheria. Considerable regional differences have existed in the rate of decrease for the attack rates during 1946-7 expressed as a percentage of those in 1935-8 have ranged from 9.5 per cent. in London to 19.4 in the northern counties. The notifications in 1947 were one-eighth or less of the mean number in 1935-8 in four regions but in three regions the proportion was almost twice this value. Variations are also apparent in the rate of decline between density areas of the same region. A change occurred in the age and sex distributions of the notified cases of diphtheria during the four years 1944-7. The pre-school child has not been, proportionately, so well protected as the older child for children under 5 years of age contributed 5.2 per cent. more while children aged 5-14 contributed 7.7 per cent. less of the total notifications in 1947 than in 1944.

The experience of America shows that a continuous effort is required to reduce the incidence to a low level and to maintain that level. The notifications of diphtheria in the United States showed a 6 per cent. rise in 1946 over 1940 for the whole country; in nine States the rise was over 100 per cent. and in two of these States there was a fivefold increase.

AN ALTERNATIVE METHOD OF COMPUTING SERIAL FATALITY RATES

WILLIAM P. D. LOGAN, B.Sc., M.D., D.P.H., General Register Office

Since the beginning of 1948 the Registrar-General's Weekly Returns have no longer shown deaths due to measles. As a result, batch fatality rates for measles can no longer be computed by Butler's method.*

* Proc. Roy. Stat. Soc., (1945) **108**, p. 259.

TABLE 2

Notifications in 1946 *and* 1947 *expressed as a percentage of the mean number of notifications in* 1935-8

Region	County Boroughs		Urban Districts		Rural Districts		All Areas	
	1946	1947	1946	1947	1946	1947	1946	1947
London	—	—	—	—	—	—	16	12
South Eastern	21	10	26	13	23	16	24	12
South Western	17	24	41	18	31	17	29	20
South Midland	102	32	26	7	20	13	27	8
Eastern	37	18	25	13	22	10	30	14
West Midland	43	29	37	28	31	20	40	27
North Midland...	27	17	19	10	31	11	25	13
North Western	38	27	27	14	32	20	34	22
Yorkshire	21	10	27	11	27	17	23	11
Northern	36	19	41	18	29	13	36	17
Wales	23	9	31	17	32	18	29	15
England & Wales	32	20	29	14	29	16	29	17

In nearly all the density areas the incidence of diphtheria in 1947 showed a large improvement on the experience of 1946. (The only outstanding exception, the county boroughs of the south-western counties, was due to Plymouth where the corrected notifications of 1947 were 75 per cent. above those of 1946.) The decline in incidence for the total of the density areas has been less in the county boroughs than in either the urban or rural areas but there are some exceptions to the general trend within regions, e.g., in the south-eastern counties, Yorkshire and Wales the notifications in the county boroughs reached a relatively lower value in 1947 than in the urban or rural districts. For the whole country the rate of decline in the urban districts has been very slightly greater than in the rural districts but in four of the ten regions the fall has been greatest in the rural districts. The relatively large number of notifications in the county boroughs of the south midland counties in 1946 was due to an outbreak in the city of Northampton which commenced during the week ending January 12 with 25 notifications.

It would be expected that the creation of a large immunised population would have some effect on the age and sex distribution of the disease. It is not, however, possible to determine the total effects since age and sex was not distinguished in the returns of notifiable diseases until 1944. The trends from this year can be compared and these are set out in Table 3.

TABLE 3

Age and sex distributions of diphtheria notifications

Age	Notifications per 1,000,000					No. of females notified per 100 males			
	1944	1945	1946	1947	1947 as a percentage of 1944	1944	1945	1946	1947
0– ...	1,378	1,043	728	373	27	87	84	80	71
5– ...	2,561	2,090	1,224	563	22	104	107	97	94
10– ...	1,558	1,242	768	314	20	119	119	129	138
15– ...	579	444	314	143	25	256	231	255	221
25– ...	88	71	59	29	33	362	338	211	208
All Ages	516	408	269	126	24	134	131	127	119

It is the purpose of this note to describe an alternative method of computation which makes use of data published in the Registrar-General's Statistical Review (Part I) and which yields results comparable with those of Butler.

The batch fatality rates at the terminal week of each successive period—measles 9 weeks, whooping cough 11 weeks—were calculated by Butler according to these formulae:—

Measles. $\frac{\text{The sum of the deaths during last 5 weeks} \times 1{,}000}{\text{Half the sum of the cases of the first 4 weeks} + \text{all the cases of the middle week} + \text{half the sum of the cases of the last 4 weeks.}}$

Whooping Cough. $\frac{\text{The sum of the deaths during last 6 weeks} \times 1{,}000}{\text{Half the sum of the cases of the first 5 weeks} + \text{all the cases of the middle week} + \text{half the sum of the cases of the last 5 weeks.}}$

It should be noted (1) that the cases (actually "notifications") and deaths were those only of London and the Great Towns, (2) that the fatality rate was defined to be that of the terminal week of each period, not the middle of the period during which the deaths occurred, and (3) that fluctuations in deaths in single weeks would not seriously disturb the series of weekly batch fatality rates since these were averaged over a moving period of either 5 weeks (measles) or 6 weeks (whooping cough).

From the weekly batch fatality rates, Butler computed monthly rates by averaging the rates for each week within a given calendar month. Since the mid point of each 5 or 6 week period of deaths is 2 or $2\frac{1}{2}$ weeks before the middle of the terminal week (i.e., the week to which the fatality rate by definition refers), it follows that Butler's monthly fatality rates are derived from a period of deaths approximately centred on the beginning, not the middle of each calendar month.

The alternative method now to be described deals with deaths and notifications for England and Wales, not merely for London and the Great Towns, and yields monthly fatality rates for periods centred on the middle not the beginning of each calendar month.

Procedure:

From Table 23 of the Registrar-General's Statistical Review (Part 1) obtain monthly numbers of deaths (d) attributed to, e.g., measles. Let number of days in month be x. Hence $\frac{7d}{x}$ is the average weekly number of deaths in each month.

From Table 27 obtain for every week the percentage ratio of that week's notifications to the weekly average for the year. If p is the percentage in one week, and N the average weekly number of notifications, then the number of notifications in the week is $\frac{Np}{100}$. If S_0 is the sum of the weekly percentages in a month, and S_1 is the corresponding sum in the preceding month, the total number of notifications in the weeks constituting the 2 months is given by $N(S_1 + S_0)/100$. If there are w weeks in the 2 months the average number of notifications per week for the two-month period is

$$N(S_1 + S_0)/100\ w$$

Deaths and notifications having now been reduced to the same scale, viz., average number per week, we may define the monthly fatality rate per 1,000

notifications as "average weekly deaths during a month multiplied by 1,000 and divided by average weekly notifications during the same and the preceding month".

Expressing this symbolically we have

**Monthly Fatality Rate $= 1{,}000 \times \frac{7d}{x} \times \frac{100\,w}{N(S_1 \times S_0)}$

In the accompanying table are shown, for years 1942 and 1943, (1) Butler's monthly average fatality rates for whooping cough and measles (from Monthly Bulletin of Ministry of Health, May, 1948, p. 108), (2) these rates adjusted by averaging successive pairs to yield mid-month rates, and (3) monthly rates calculated by the new method.

Monthly Fatality Rates per thousand notifications
Whooping Cough and Measles, 1942-43

	Whooping Cough			Measles		
	Butler*	Butler* (Adjusted)	New† Method	Butler*	Butler* (Adjusted)	New† Method
1942—January ...	14·2	14·50	14·77	1·7	2·15	2·10
February...	14·8	13·95	10·93	2·6	3·00	3·58
March ...	13·1	14·70	14·24	3·4	2·85	2·17
April ...	16·3	16·25	15·66	2·3	2·30	2·65
May ...	16·2	14·00	13·75	2·3	2·35	1·80
June ...	11·8	10·55	9·66	2·4	1·90	1·86
July ...	9·3	9·00	8·15	1·4	1·30	0·81
August ...	8·7	9·85	8·12	1·2	1·10	1·03
September	11·0	12·70	12·06	1·0	1·50	1·15
October ...	14·4	13·55	9·35	2·0	1·90	1·98
November	12·7	13·50	10·74	1·8	2·00	2·04
December	14·3	14·80	13·03	2·2	2·30	2·32
1943—January ...	15·3	16·05	16·55	2·4	2·40	2·55
February...	16·8	15·75	13·65	2·4	2·55	2·39
March ...	14·7	14·55	14·47	2·7	2·60	2·25
April ...	14·4	13·40	12·50	2·5	2·15	1·75
May ...	12·4	11·50	11·33	1·8	1·50	1·19
June ...	10·6	9·50	9·23	1·2	0·90	0·76
July ...	8·4	8·45	6·84	0·6	0·95	0·71
August ...	8·5	9·50	9·25	1·3	1·95	0·95
September	10·5	11·40	10·98	2·6	2·65	1·70
October ...	12·3	11·35	9·62	2·7	3·05	2·01
November	10·4	12·85	12·47	3·4	3·30	2·04
December	15·3	15·50	17·02	3·2	3·05	3·95

* London and Great Towns only.
† England and Wales.

In each disease there is a fairly close resemblance between the series of new rates (for England and Wales) and Butler's adjusted rates (for London and the Great Towns), and this is brought out more clearly in the chart. Butler's rates, being based on moving averages, present smoother curves,

** For the month of January it is necessary to modify the denominator since the December weekly percentages obtained from the preceding year's Statistical Review are percentages of the preceding year's weekly average (N^1). The number of notifications for December and January is therefore $(N^1S_1 + NS_0)/100$ and the formula for the January fatality rate is

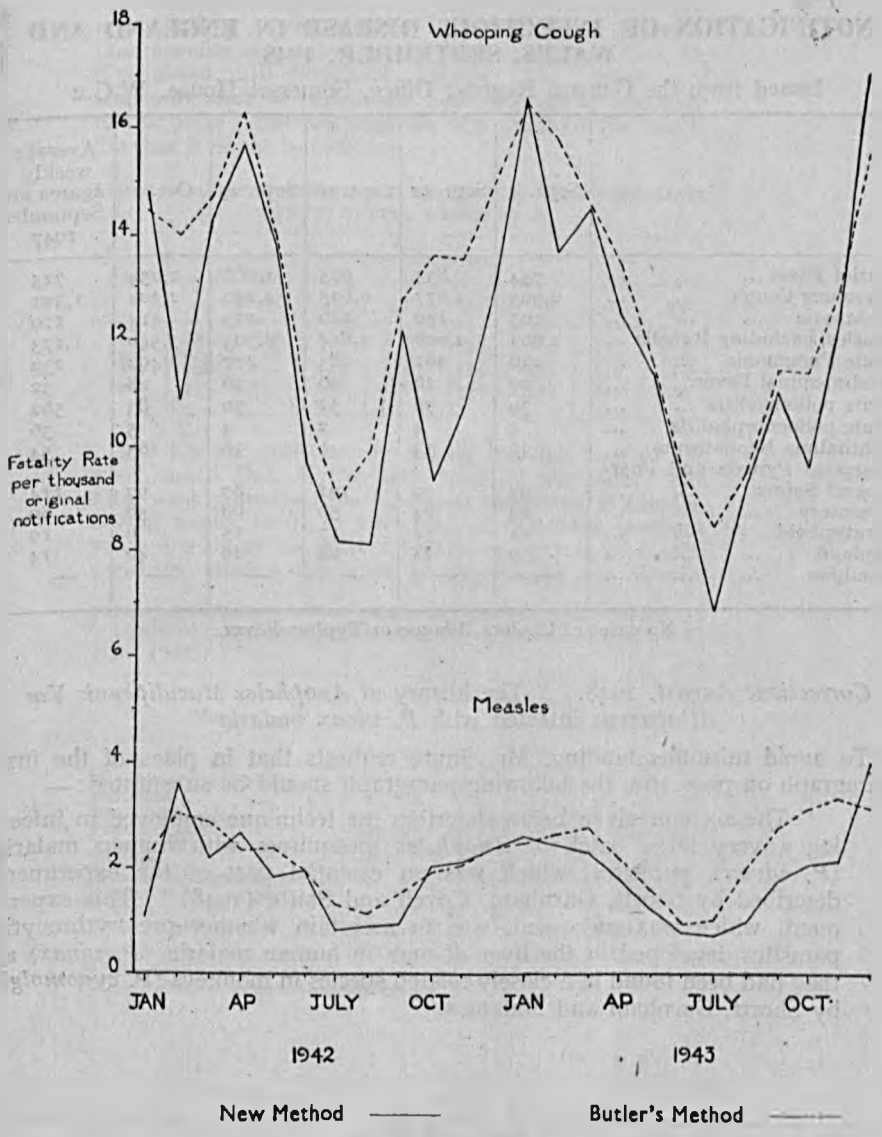
$$1000 \times \frac{7d}{x} \times \frac{100\,w}{N^1S_1 + NS_0}$$

but this is not necessarily an advantage. A September peak of fatality in whooping cough in both years, clearly demonstrated by the new method, is smoothed out by Butler's method.

It is a property of Butler's batch fatality rates that the weekly data on which they were based were published with the minimum of delay after the

SERIAL MONTHLY FATALITY RATES

ENGLAND & WALES. 1942-1943



events to which they relate. Thus the rates could be made available at any time in the course of an epidemic. The alternative method uses data which are not published immediately, and the rates which it yields are only of historical value.

In spite of this limitation the alternative method provides serial rates comparable with but (as they relate to the whole of England and Wales) more comprehensive than those of Butler, and at least equally capable of yielding information about periodic variations in fatality.

I am indebted to Dr. Percy Stocks, General Register Office, for the suggestion of computing serial fatality rates by the method above described.

NOTIFICATION OF INFECTIOUS DISEASE IN ENGLAND AND WALES, SEPTEMBER, 1948

Issued from the General Register Office, Somerset House, W.C.2

	Sept. 4	Sept. 11	Sept. 18	Sept. 25	Oct. 2	Average weekly figures for September 1947
Scarlet Fever	734	833	925	1,068	1,234	725
Whooping Cough	2,995	2,877	2,635	2,259	2,204	1,321
Diphtheria	105	136	126	125	114	170
Measles, excluding Rubella ...	2,962	2,608	2,614	2,703	3,546	1,173
Acute Pneumonia	246	261	283	277	402	232
Cerebro-spinal Fever... ...	29	26	26	26	28	32
Acute poliomyelitis	70	72	72	70	83	562
Acute polioencephalitis ...	3	4	2	3	5	36
Ophthalmia Neonatorum ...	42	53	47	36	65	54
Puerperal Pyrexia and Puerperal Sepsis	94	79	101	87	97	114
Dysentery	64	84	50	68	58	80
Paratyphoid	11	32	17	15	6	19
Typhoid	9	28	28	29	40	14
Smallpox	—	—	—	—	—	—

No cases of Cholera, Plague or Typhus Fever.

Correction: August, 1948. "The history of *Anopheles Maculipennis Var Atroparvus* infected with *P. vivax malaria*"

To avoid misunderstanding, Mr. Shute requests that in place of the first paragraph on page 162, the following paragraph should be substituted:—

> "The account given below describes the technique employed in infecting a very large batch of *Anopheles* mosquitoes with human malaria (*P. vivax*), parasites, which was an essential part of the experiment described by Shortt, Garnham, Covell and Shute (1948).[1] This experiment, which was successful, was to ascertain whether pre-erythrocytic parasites developed in the liver of man in human malaria (*P. vivax*) as they had been found in a closely related species in monkeys (*P. cynomolgi*) by Shortt, Garnham and Malamos."[2]

[1] B.M.J., 1948, i, 547. [2] Ibid, 1948, i, 192.

Reprinted from THE LANCET, *Jan.* 8, 1949, *p.* 78.

FOG AND MORTALITY

W. P. D. LOGAN
M.D., B.Sc. Glasg., D.P.H.
ASSISTANT MEDICAL STATISTICIAN, GENERAL REGISTER OFFICE

THE dense fog that enveloped London and much of the country during the closing days of November, 1948, established a record, not for density but for duration. Commencing in London on the night of Friday, Nov. 26, it persisted until Wednesday, Dec. 1. The disruption of transport that it occasioned received ample comment in the press; but less mention was made of the toll in life that it might be exacting.

TABLE I—DEATHS REGISTERED IN LONDON (ADMINISTRATIVE COUNTY) DURING WEEKS 44–51

Year	Week No.							
	44	45	46	47	*48*	49	50	51
1945	593	639	638	707	739	734	907	979
1946	654	742	780	753	778	727	887	945
1947	739	771	742	799	721	861	817	779
1948	811	801	846	779	*1019*	944	891	738

The fog occurred mainly during the first half of the week ended Dec. 4, the 48th week of the year. The total weekly deaths from all causes registered in London during weeks 44–51 of 1948 and of the three previous years are shown in table I.* The sharp rise in deaths registered during the week of fog stands out clearly,

TABLE II—DEATHS FROM SELECTED CAUSES REGISTERED IN LONDON (ADMINISTRATIVE COUNTY) DURING WEEKS 44–51 OF 1948

Cause	Week No.							
	44	45	46	47	*48*	49	50	51
Respiratory tuberculosis	33	36	44	36	*46*	45	37	34
Influenza	1	2	3	2	*3*	4	2	2
Bronchitis	63	57	68	73	*148*	103	88	55
Pneumonia	32	42	46	29	*73*	71	67	51
Road traffic accidents	5	8	9	3	*9*	6	2	4
Old age	8	7	7	8	*5*	13	9	8
Myocardial degeneration	95	97	125	102	*133*	135	103	79
Cancer of respiratory system	35	48	30	31	*42*	34	20	20
Cancer of other sites	135	119	135	118	*148*	115	146	123

* The figures in this and the subsequent tables are taken from the Registrar-General's weekly return.

TABLE III—DEATHS FROM BRONCHITIS AT VARIOUS AGES, REGISTERED IN LONDON (ADMINISTRATIVE COUNTY) DURING WEEKS 44–51 OF 1948

Age (years)	Week No.							
	44	45	46	47	48	49	50	51
<1	2	..	4	..	2	4	7	1
1–14	2	..	..	..	2	1	1	..
15–44	..	2	1	6	4	5	4	4
45–64	11	11	13	8	32	19	20	8
65+	48	44	50	59	108	74	56	45

TABLE IV—DEATHS FROM PNEUMONIA (ALL FORMS) AT VARIOUS AGES, REGISTERED IN LONDON (ADMINISTRATIVE COUNTY) DURING WEEKS 44–51 OF 1948

<1	7	4	12	4	6	19	12	13
1–14	1	..	2	3	2	4	4	1
15–44	..	..	2	1	5	..	1	..
45–64	6	8	6	4	19	11	11	9
65+	18	30	24	17	41	37	39	28

20–30% more deaths being recorded in that week than in each of the 4 previous weeks. The effect continued into the 49th and perhaps the 50th week of the year.

Table II shows the number of deaths ascribed to various causes during these 8 weeks. As was to be expected, much of the increased mortality was due to respiratory infection. Registered deaths due to bronchitis and to pneumonia more than doubled during the 48th week, deaths from most other causes being little if any higher than in the previous 4 weeks. There was, however, some increase in deaths from myocardial degeneration and cancer.

The ages at which bronchitis and pneumonia caused death are shown in tables III and IV. During the fog week there was no increased mortality from either disease at ages under 45. The increase was numerically greater above the age of 65 but proportionately greater in the 45–64 age-group. In the next 2 weeks (49 and 50) bronchitis deaths returned practically to their normal level, but not so the deaths due to pneumonia especially among the elderly. The registered mortality from pneumonia in infancy was not increased during the week of fog but rose to a high level in the following week.

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Section of Preventive Medicine

W. P. D. LOGAN, B.Sc., M.D., D.P.H.
STATISTICIAN (MEDICAL), GENERAL REGISTER OFFICE

General Register Office Activity in the Field of Morbidity Statistics

The following is a brief outline of the fields in which the General Register Office is engaged or is about to be engaged in connexion with morbidity statistics.

Notifiable infectious disease

The compilation of statistics relating to infectious disease has gone on for many years and is too well known to require elaboration here. The General Register Office now receives quarterly details of the sex and age, and of amendments in diagnosis, of all notified patients. In addition, the department has recently assumed responsibility for analysing the figures of diphtheria immunization and tuberculosis notifications.

Survey of sickness

Since 1943, Social Surveys has carried out monthly inquiries among random samples consisting of between 2,500 and 3,000 persons aged 16 years and over, scattered over England and Wales. The inquiries relate to the illnesses suffered by the individuals in the 3 months prior to the interview, the nature and severity of the illnesses, the duration of incapacity, and whether and how often a medical practitioner was consulted. The coding of the illnesses is carried out by the General Register Office, and since the beginning of 1947 statistical tables giving certain of the results of the surveys have been published in the Registrar-General's Quarterly Returns. Fuller appraisal of the results will appear in the annual *Statistical Reviews* and occasional publications of the department, and brief commentaries have appeared from time to time in the *Monthly Bulletin of the Ministry of Health.*

The registration and follow-up of patients with cancer

Every patient suffering from cancer, who attends one of the cancer treatment centres which is using the recording system started by the Radium Commission, is registered and followed up. Abstract cards containing details of age, sex, diagnosis, treatment,

and progress are prepared by the cancer centres for all their patients, and these cards are sent to the General Register Office every 2 years so that the history of each patient can be recorded. The General Register Office is analysing the statistical data. It is hoped gradually to bring into this scheme the bulk of the cancer cases in Great Britain.

Mental hospitals and mental deficiency institutions

Commencing on 1 January 1949, returns will be made to the General Register Office of all admissions to and discharges from mental hospitals and mental deficiency institutions. These returns will include details of the illness and of the patients' familial and environmental backgrounds.

By the end of 1949 it is proposed to secure information about all patients then in these hospitals and institutions.

General hospitals

During 1949, the General Register Office will, under present arrangements, receive from the teaching hospitals and some other general hospitals returns of all in-patient discharges, with information about final diagnosis, complications, accessory conditions, and, in the case of injuries, details about the cause of the injuries.

It is hoped at a later date to extend this survey to include all general hospitals or a fully representative sample.

School absenteeism

Since September 1947, a survey has been carried out of the causes of absenteeism from a selected group of schools serving urban and rural areas in certain parts of the North and Midlands. The school population under survey numbers about 12,000 children aged 5–14 years. The data are classified by the General Register Office. This survey will be continued in the first instance for 12 months only.

Emergency Medical Service hospitals

For the purposes of the compilation of the medical history of the war, the Ministry of Health and the General Register Office have been carrying out an analysis of a 1 in 5 sample of in-patient admissions to Emergency Medical Service hospitals. At the same time, an analysis of all out-patients has also been made. As the number of admissions to these hospitals has now become comparatively small, this investigation is drawing to a close.

This outline illustrates the present considerable range of activity of the General Register Office with regard to morbidity statistics and indicates the further contribution that it is about to make in this field. We rely on the medical profession to let us know how, in their opinion, we can increase our usefulness to the profession and to the public.

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SECTION I.—GENERAL

Issued from the Office of the Ministry of Health, Whitehall, S.W.1.

MORTALITY DURING INFANCY FROM SOME COMMON INFECTIOUS DISEASES, 1911-47.

W. P. D. Logan, B.Sc., M.D., D.P.H. (General Register Office, W.C.2).

During the first few weeks of life the majority of children seem to be resistant to attack by the common infectious diseases of childhood. But their immunity does not last; before they are a year old many of them contract whooping cough or measles, a few get diphtheria or scarlet fever, and some get German measles, chickenpox, or mumps. Although, compared with older children, the number of cases among infants (i.e. children under one year) is small, fatality is high and deaths among infants make a substantial contribution towards the total mortality of these diseases. During 1941-47 about half of the deaths at all ages from whooping cough and chickenpox and about a third of the deaths from measles and German measles were in infants; and to the total deaths from mumps, scarlet fever and diphtheria infants contributed 10 per cent., 4 per cent. and 3 per cent. respectively. Table 1 shows how these proportions have varied since 1911-20. Between 1931-40 and 1941-47 the proportion of infant deaths from whooping cough, measles, and German measles rose sharply, while smaller increases were registered by the four other diseases.

TABLE 1. *Deaths and population under one year per cent. of deaths and population at all ages. England and Wales*, 1911–47

	1911–20	1921–30	1931–40	1941–47
Population	2·1	1·8	1·4	1·7
Scarlet Fever	3·3	3·0	3·1	4·1
Whooping Cough	44·2	44·4	48·2	58·0
Diphtheria	3·8	4·2	2·5	3·2
Measles	19·6	21·3	21·1	33·4
German Measles	20·2	27·4	26·7	37·1
Chickenpox	53·1	47·6	39·2	44·4
Mumps	12·8	15·1	9·3	9·6

Mean annual infant death rates at various ages within the first year per million live births are shown in Table 2, all rates having been adjusted to the 1940 classification of causes of death. Of the seven diseases whooping cough has persistently caused the highest mortality (see diagram). Measles came next followed at a much lower level by diphtheria, and still lower by scarlet fever, chickenpox, German measles, and mumps.

The rates in Table 2, based at each age on total live births and relating to deaths in age intervals that vary from 4 to 26 weeks tend to give a false impression of the comparative risk of death at the different ages. Table 3 attempts to correct this by giving the probability of death from each cause at each age after adjustment has been made for the diminishing numbers entering each age interval and the different durations of the intervals. In scarlet fever and measles the risk in both of the time-periods 1911-20 and 1941-47 increased abruptly at 6-12 months. The same was true of diphtheria in 1911-20, but in 1941-47 the risk of death from diphtheria remained fairly steady throughout the first year though it dropped at 3-6 months. In whooping cough, the risk in 1911-20 was almost constant after 4 weeks, but

TABLE 2. *Mean Annual Death Rates at ages under one year per million live births. England and Wales, 1911–47*

(All rates adjusted to 1940 classification)

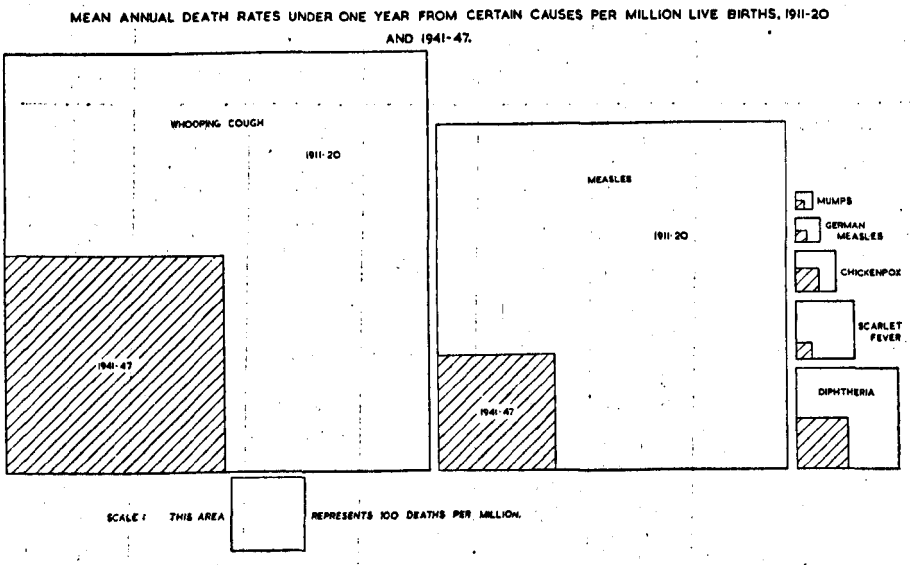
		Under 4 weeks	4 weeks–3 months	3–6 months	6–12 months	Total under 1 year
Scarlet Fever ...	1911–20	1·60	3·31	8·23	50·7	64
	1921–30	2·34	2·08	3·37	27·0	35
	1931–40	0·99	1·81	1·65	19·0	23
	1941–47	—	0·59	0·40	4·2	5
Whooping Cough ...	1911–20	93	624	776	1,861	3,354
	1921–30	68	503	579	1,440	2,590
	1931–40	32	297	338	700	1,368
	1941–47	17	233	261	381	892
Diphtheria	1911–20	6·7	12·1	21	157	197
	1921–30	6·2	15·4	20	114	156
	1931–40	6·4	14·3	16	63	100
	1941–47	4·4	9·5	7·1	30	51
Measles	1911–20	22	53	153	2,036	2,264
	1921–30	10	35	89	1,064	1,198
	1931–40	6·3	24	64	578	673
	1941–47	2·4	17	45	213	277
German Measles ...	1911–20	0·21	1·16	2·86	6·5	10·7
	1921–30	0·36	0·48	1·08	5·5	7·5
	1931–40	0·16	0·33	1·32	3·0	4·8
	1941–47	0·59	0·40	0·79	0·8	2·6
Chickenpox	1911–20	1·35	3·01	6·8	21	32
	1921–30	0·99	1·44	5·8	15	23
	1931–40	0·33	0·82	3·8	9·4	14
	1941–47	1·19	1·19	2·8	5·2	10
Mumps	1911–20	0·12	1·36	1·11	3·3	5·9
	1921–30	0·56	1·68	0·84	2·2	5·3
	1931–40	0·16	0·49	0·16	1·6	2·5
	1941–47	0·40	0·20	0·40	0·4	1·4

in 1941-47 it was greatest at 4 weeks-3 months and became less at later ages. For German measles, chicken-pox, and mumps, whereas in 1911-20 the risk tended to increase with age, in 1941-47 the risk was greatest in the youngest and least in the oldest infants.

The percentage distribution of deaths at ages under one in 1911-20 and 1941-47 are compared in Table 4. At both periods about 80 per cent. of infant deaths from scarlet fever and measles were at 6-12 months. In 1911-20 just under half and in 1941-47 just over half of the infant whooping cough deaths were in the first six months and these were almost equally divided between 4 weeks-3 months and 3-6 months. The proportion of infant diphtheria deaths in the first six months, 20 per cent. in 1911-20, increased to over 40 per cent. in 1941-47.

To show more clearly how the various death rates have declined Table 5 gives the death rates in 1941-47 (from Table 2) as a percentage of those in 1911-20. The total infant mortality rates from scarlet fever and measles dropped to about a tenth of the initial level and the rates for the others dropped to about a quarter. For each disease the decline at 6-12 months was greater than in the first six months. Ignoring the high figures at

0-4 weeks for German measles and mumps which have been derived from only one or two deaths, the greatest variation at different ages has been in diphtheria where the decline at under 3 months was only a third of that



at 3-6 months. Table 2 has indicated that whereas the diphtheria death rate at 3-6 months has declined steadily since 1911-20, at 4-weeks-3 months it has begun to decline only recently.

Although deaths in infancy from these infectious diseases constitute quite a large proportion of the total mortality of the diseases at all ages, most of them contribute little towards the general infant mortality rate. The only ones causing more than 1 per cent. of all deaths in infants were whooping

TABLE 3. *Comparative Risk of dying from specified cause during 4 weeks at ages under one year, per million entering each age*

		Under 4 weeks	4 weeks–3 months	3–6 months	6–12 months
Scarlet Fever	1911–20	1·60	1·53	2·68	8·42
	1941–47	—	0·27	0·13	0·67
Whooping Cough	1911–20	93	288	253	309
	1941–47	17	106	83	61
Diphtheria	1911–20	6·7	5·6	6·8	26
	1941–47	4·4	4·3	2·3	5
Measles	1911–20	22	24	50	338
	1941–47	2·4	8	14	34
German Measles	1911–20	0·21	0·54	0·93	1·08
	1941–47	0·59	0·18	0·25	0·13
Chickenpox	1911–20	1·35	1·39	2·2	3·5
	1941–47	1·19	0·54	0·9	0·8
Mumps	1911–20	0·12	0·63	0·36	0·55
	1941–47	0·40	0·09	0·13	0·06

cough and measles (Table 6), and at each age of infancy these have declined in importance since 1911-20. Whooping cough in 1911-20 was responsible for 3.3 per cent. of the total infant mortality and for 7 per cent. of deaths at 6-12 months; in 1941-47 the proportions were 1.9 per cent. of the total under a year and 5.9 per cent. at 6-12 months. In 1911-20 the measles proportion at 6-12 months (7.6 per cent.) exceeded that of whooping cough but in 1941-47 it had dropped to second place with 3.3 per cent., and

TABLE 4. *Percentage distribution of deaths at various ages under one year*

		Under 4 weeks	4 weeks–3 months	3–6 months	6–12 months	Under 1 year	Number of deaths under 1 year
Scarlet Fever ...	1911–20	3	5	13	79	*100*	517
	1941–47	—	12	8	80	*100*	26
Whooping Cough	1911–20	3	19	23	55	*100*	27,161
	1941–47	2	26	29	43	*100*	4,500
Diphtheria ...	1911–20	3	6	11	80	*100*	1,591
	1941–47	9	19	14	58	*100*	258
Measles ...	1911–20	1	2	7	90	*100*	18,329
	1941–47	1	6	16	77	*100*	1,397
German Measles	1911–20	2	11	27	60	*100*	87
	1941–47	23	15	31	31	*100*	13
Chickenpox ...	1911–20	4	9	21	66	*100*	261
	1941–47	12	12	27	49	*100*	52
Mumps ...	1911–20	2	23	19	56	*100*	48
	1941–47	28·5	14·5	28·5	28·5	*100*	7

among all deaths under a year the proportion ascribed to measles dropped from 2.3 per cent. to 0.6 per cent. The table shows clearly how much more important has been whooping cough than the others in contributing to the total deaths at ages under 6 months. At 4 weeks-3 months whooping

TABLE 5. *Death rates in* 1941-47 *per cent. of* 1911–20

		Under 4 weeks	4 weeks–3 months	3–6 months	6–12 months	Total under 1 year
1911–20	Each cause ...	100	100	100	100	100
1941–47	Scarlet Fever ...	—	18	5	8	8
	Whooping Cough ...	18	37	34	20	27
	Diphtheria	65	78	34	19	26
	Measles	11	32	29	10	12
	German Measles ...	281	34	28	12	24
	Chickenpox ...	88	40	41	24	32
	Mumps	321	15	36	12	23

cough accounted for almost 3 per cent. of the total deaths in 1941-47 while measles and diphtheria together accounted for only 0.3 per cent. Scarlet fever has not in recent times been an important cause of death in infancy. Even 75 years ago when it was a more serious disease than it has recently become it caused less than 1 per cent. of infant deaths; and by 1941-47 out of every ten thousand infant deaths only one was attributed to scarlet fever.

It has been necessary to confine this analysis to mortality only. To determine whether the decline in the death rate of these infectious diseases among infants has been the result of a reduction in prevalence or in fatality would require more complete morbidity statistics than are yet available. Details of the age of attack of notified infectious diseases have been collected centrally only since 1944. It can be accepted that the fall in the diphtheria death rate among infants has resulted from a reduction both in morbidity

TABLE 6. *Deaths from specified causes per cent. of deaths from all causes under one year:* 1911–20 *and* 1941–47

		Under 4 weeks	4 weeks–3 months	3–6 months	6–12 months	Total Under 1 year
Scarlet Fever ...	1911–20	0·004	0·018	0·048	0·191	0·064
	1941–47	—	0·007	0·006	0·065	0·011
Whooping Cough ...	1911–20	0·245	3·381	4·497	6·989	3·340
	1941–47	0·067	2·836	3·710	5·941	1·906
Diphtheria	1911–20	0·018	0·066	0·120	0·589	0·196
	1941–47	0·017	0·116	0·101	0·469	0·109
Measles	1911–20	0·057	0·285	0·889	7·646	2·254
	1941–47	0·009	0·205	0·634	3·320	0·592
German Measles ...	1911–20	0·001	0·006	0·017	0·024	0·011
	1941–47	0·002	0·005	0·011	0·012	0·006
Chickenpox	1911–20	0·004	0·016	0·039	0·079	0·032
	1941–47	0·005	0·014	0·039	0·080	0·022
Mumps	1911–20	0·001	0·007	0·006	0·013	0·006
	1941–47	0·002	0·002	0·006	0·006	0·003

and in fatality. The recently diminished prevalence amongst older children has reduced the infants' chances of being infected, and infant fatality has been reduced probably as the result of increased resistance and more effective treatment. Immunisation of infants can have played only a minor part, as only about 5 per cent. of children are immunised before they are a year old. With regard, however, to the six other diseases it is by no means certain that there has been any material decline in prevalence among infants. The reduction in infant mortality from these causes may well be the result almost solely of lessened fatality.

THE ENIGMA OF NOTIFIED DYSENTERY. II.

J. Alison Glover, C.B.E., M.D., F.R.C.P., D.P.H.

"'Tis time to observe occurrences, and let nothing escape us" (*Sir Thomas Browne. "Hydrotaphia."*)

In this Bulletin for March, 1947, I called attention to various anomalies manifest in the notification of dysentery. The most striking of these was the enormous increase in notifications which began in 1925, proceeded slowly for eleven years and then, with three major bounds in 1937, 1941 and 1944, rose to a great peak of 16,278* in 1945, 47 times as many as those (345) in 1925, the year of the fewest notifications since the first world war. Almost

* 1,519 of these notifications were of non-civilian cases.

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SECTION I.—GENERAL

Issued from the Office of the Ministry of Health, Whitehall, S.W.1.

POLIOMYELITIS, 1950: PARALYTIC AND NON-PARALYTIC

by W. P. D. Logan, B.Sc., M.D., D.P.H., General Register Office, W.C.2.

Since the beginning of 1950 poliomyelitis has been notifiable in England and Wales as "paralytic" or "non-paralytic", a distinction introduced in order that the Public Health authorities should have a clearer understanding of the nature of any local or general epidemic prevalences that might arise. In previous years it was not possible to estimate from the weekly figures what proportion of notifications related only to doubtful, suspicious, or abortive forms of the disease and as this proportion no doubt varied from time to time and from place to place it was sometimes difficult to grasp the true state and course of events.

By distinguishing between paralytic and non-paralytic cases the new notification procedure has helped to remove this source of uncertainty, and though, at the time of writing, this year's weekly notifications are still rising, it may be of interest to indicate what proportion of paralytic and non-paralytic cases have so far been notified in different parts of the country.

The trend of weekly *original* notifications (paralytic and non-paralytic) in 1950 up to week ended 12th August, compared with 1947 and 1949, is illustrated in Diagram 1, based on the figures given each week on page 2 of the Registrar-General's Weekly Return. By the week ended 12th August, 1950, the total original notifications from the beginning of the year were 2,985, of which 2,140, or 72 per cent., were reported as paralytic and 845, or 28 per cent., as non-paralytic cases.

TABLE I

Total original cases of poliomyelitis notified in England and Wales and the geographical regions from the beginning of 1950 *to the week ended* 12*th August, with cases notified during the* 32 *corresponding weeks of* 1949 *and* 1947.

	1950 Number to 12th August	1949 Number to 13th August	1947 Number† to 9th August
England and Wales	2,985*	1,457*	2,252*
London Administrative County ...	245	163	304
Remainder of South East	593	444	576
North I	133	25	193
North II	49	30	110
North III	195	165	323
North IV	270	145	241
Midland I	937	133	233
Midland II	180	77	66
East	152	63	60
South West	91	146	60
Wales I	105	51	67
Wales II	33	12	17

* Including cases in Port Health Districts, 1950, 2; 1949, 3; 1947, 2.
† In the following week (ended 16th August) 691 cases were notified in England and Wales.

Diagram 1. Original weekly notifications, England and Wales, 1947, 1949 and 1950

TABLE 2

Aggregate of weekly original notifications for the 10-week period from the week ended 10th June to 12th August, 1950, by geographical regions and density aggregates, England and Wales; Percentages paralytic and non-paralytic; case rates per 100,000 living (calculated as annual rates).

	Numbers of cases		Percentages		Case rates per 100,000 living	
	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic
England and Wales ...	1,583*	641	71	29	19	8
County Boroughs ...	676	221	75	25	26	8
Other urban districts ...	579	240	71	29	17	7
Rural districts	217	112	66	34	14	7
London Administrative County	109	68	62	38	17	10
Remainder of South East	295	115	72	28	13	5
County Boroughs ...	47	18	72	28	14	5
Other urban districts ...	198	79	71	29	13	5
Rural districts	50	18	74	26	13	5
North I	68	53	56	44	16	12
County Boroughs ...	27	32	46	54	15	18
Other urban districts ...	26	17	60	40	14	9
Rural districts	15	4	79	21	20	5
North II	25	5	83	17	9	2
County Boroughs ...	7	—	100	—	7	—
Other urban districts ...	9	1	90	10	11	0
Rural districts	9	4	69	31	11	5
North III	83	30	73	27	12	4
County Boroughs ...	52	18	74	26	14	5
Other urban districts ...	23	9	72	28	10	4
Rural districts	8	3	73	27	10	4
North IV	144	49	75	25	12	4
County Boroughs ...	98	33	75	25	15	5
Other urban districts ...	41	13	76	24	9	3
Rural districts	5	3	63	37	6	3
Midland I	610	189	76	24	60	18
County Boroughs ...	381	83	82	18	72	16
Other urban districts ...	179	85	68	32	60	28
Rural districts	50	21	70	30	26	11
Midland II	70	42	62	38	14	8
County Boroughs ...	35	23	60	40	22	14
Other urban districts ...	22	9	71	29	11	4
Rural districts	13	10	57	43	9	7
East	67	38	64	36	17	10
County Boroughs ...	14	4	78	22	17	5
Other urban districts ...	18	3	86	14	15	3
Rural districts	35	31	53	47	19	17
South West	40	19	68	32	9	4
County Boroughs ...	2	1	67	33	3	1
Other urban districts ...	23	11	68	32	12	6
Rural districts	15	7	68	32	8	4
Wales I	47	27	64	36	13	8
County Boroughs ...	13	9	59	41	12	8
Other urban districts ...	25	9	74	26	15	5
Rural districts	9	9	50	50	12	12
Wales II†	23	6	79	21	16	4
Other urban districts ...	15	4	79	21	23	6
Rural districts	8	2	80	20	11	3

* Including two cases in Port Health Districts. † No County Boroughs in this region.

Table 1 gives numbers of original notifications (paralytic and non-paralytic combined) from the beginning of this year to week ended 12th August, by

geographical regions,* compared with the numbers notified to the end of the corresponding week of 1947 and 1949. By far the heaviest incidence so far this year has been in the Midland I region, in which the Birmingham area has been much involved. In relation to population incidence has been rather high also in North I, London, and the East region, but much lower than in Midland I. Localised outbreaks that have attracted some publicity have been reported from Lincolnshire (East region) and from Isle of Wight (South-East region).

Table 2 gives the aggregate numbers and rates of paralytic and non-paralytic cases notified during the 10-week period from week ended 10th June to 12th August, 1950, by geographical regions and density aggregates (county boroughs, other urban districts, rural districts) with the percentages notified as paralytic or non-paralytic. The percentage of paralytic cases was 75 in the aggregated county boroughs of England and Wales, 71 in the other urban districts, 66 in the rural districts and 62 in the Administrative County of London (see Diagram 2). In the Midland I region, where the incidence of poliomyelitis has been highest, 76 per cent. of cases were notified as paralytic (82 per cent. in the county boroughs of the region, 68 per cent. in the other urban districts, and 70 per cent. in the rural districts). Apart from this region, the tendency has been for the proportion of paralytic cases to be low in areas of high incidence and to be high in areas less seriously affected. Thus the North II region, with the lowest notification rate, 11 per 100,000 for the ten weeks, reported 83 per cent. of cases as paralytic, whereas North I with the second highest notification rate, 28 per 100,000, reported only 56 per cent. of cases as paralytic. Excluding the Midland I region, the coefficient of rank correlation between notification rates and the percentage of paralytic cases in the 11 remaining regions was −0.82, indicating a significant inverse association.

TABLE 3

Total original cases notified and percentages of paralytic cases in each of the 10 weeks from week ended 10th June to 12th August, 1950. England and Wales and certain geographical regions.

	England and Wales		London Admin. County		Remainder of South East		Midland I		East		North	
	Total no. notified	Percentage paralytic	Total no. notified	Percentage paralytic	Total no. notified	Percentage paralytic	Total no. notified	Percentage paralytic	Total no. notified	Percentage paralytic	Total no. notified	Percentage paralytic
10th June ...	79	77	6	50	9	100	38	79	4	50	19	74
17th " ...	93	83	9	100	13	69	39	97	4	100	19	63
24th " ...	142	73	13	54	19	74	72	86	5	80	19	42
1st July ...	160	78	13	62	29	69	79	80	4	75	22	82
8th " ...	212	66	22	68	32	56	80	79	2	50	41	63
15th " ...	212	72	8	50	29	83	83	75	6	33	59	73
22nd " ...	261	73	28	68	45	76	92	76	10	70	57	74
29th " ...	306	65	25	60	63	63	115	69	9	44	50	68
5th August ...	367	72	28	57	81	72	111	68	29	86	76	74
12th " ...	392	70	25	52	90	77	90	76	32	47	95	71

The proportion of paralytic cases notified from week to week in the country as a whole has shown a slight tendency to decline as incidence has risen, but this has not happened in all of the regions. Table 3 gives numbers of cases

* For the constitution of the geographical regions see any recent volume of the Registrar General's Statistical Review, noting that the Administrative County of London has been adopted here instead of Greater London.

notified and the percentage paralytic during the ten successive weeks of rising incidence up to 12th August for England and Wales as a whole and for five selected areas; fuller details are given in Table 4. The average percentages of cases notified as paralytic during the first and second five weeks of the period were as follows:—

	First 5 weeks.	*Second 5 weeks.*
England and Wales	74	70
Administrative County of London ...	67	59
Remainder of South-East	69	73
North (four regions combined) ...	65	72
Midland I	83	72
East	74	62

In the South-East region (excluding London) and in the North the proportion of cases notified as paralytic was higher in the second than in the first five-week period; in London, Midland I and the East region the proportion of paralytic cases declined.

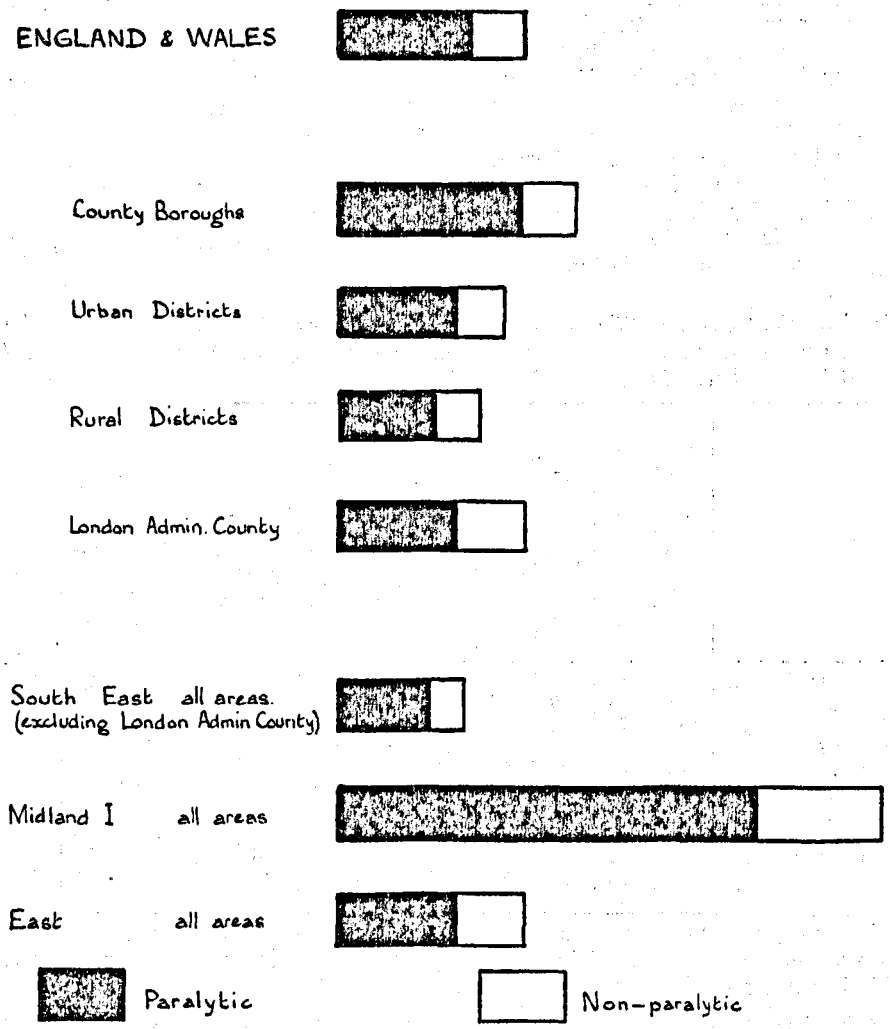

Diagram 2. Relative notification rates of paralytic and non-paralytic poliomyelitis during weeks ended 10th June to 12th August, 1950. England and Wales, density aggregates, London Administrative County, and three selected regions (Scale: the two rectangles at the bottom each represent 12 notifications per hundred thousand population).

TABLE 4

Weekly original notifications of poliomyelitis, distinguishing paralytic and non-paralytic, by geographical regions and density aggregates. England and Wales. Weeks ended 10th June to 12th August, 1950.

Week ended:—	10th June		17th June		24th June		1st July		8th July		15th July		22nd July		29th July		5th August		12th August	
	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic
England and Wales	61	18	77	16	104	38	124	36	139	73	152	60	190	71	198	108	263*	104	275*	117
County Boroughs	30	7	36	5	56	7	59	11	68	16	68	29	78	25	93	38	97	46	91	37
Other urban districts ...	22	5	25	9	32	21	51	13	45	38	62	18	65	24	64	41	101	39	112	32
Rural districts	6	3	7	2	9	4	6	7	11	12	18	9	28	13	26	19	48	7	58	36
London Admin. County ...	3	3	9	—	7	6	8	5	15	7	4	4	19	9	15	10	16	12	13	12
Remainder of South East ...	9	—	9	4	14	5	20	9	18	14	24	5	34	11	40	23	58	23	69	21
County Boroughs	1	—	1	—	2	1	5	2	2	1	7	1	9	2	5	5	11	3	4	3
Other urban districts ...	7	—	6	4	11	4	13	4	15	11	14	4	16	7	30	14	40	20	46	11
Rural districts	1	—	2	—	1	—	2	3	1	2	3	—	9	2	5	4	7	—	19	7
North I	3	1	4	2	1	4	1	3	7	6	12	9	7	7	6	6	14	8	13	7
County Boroughs	1	—	2	—	—	1	—	—	3	2	5	7	2	6	4	5	7	5	3	6
Other urban districts ...	—	1	1	2	1	2	1	3	2	2	6	2	4	1	1	—	4	3	6	1
Rural districts	2	—	1	—	—	1	—	—	2	2	1	—	1	—	1	1	3	—	4	—
North II	—	—	—	—	—	—	—	—	—	—	1	—	3	1	4	1	6	—	11	3
County Boroughs	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	3	—	3	—
Other urban districts ...	—	—	—	—	—	—	—	—	—	—	—	—	2	—	1	—	3	—	3	1
Rural districts	—	—	—	—	—	—	—	—	—	—	—	—	1	1	3	1	—	—	5	2
North III	6	3	3	1	4	2	4	1	3	4	9	2	9	3	11	3	19	5	15	6
County Boroughs	5	3	1	1	1	—	2	1	2	2	5	2	5	2	8	—	13	3	10	4
Other urban districts ...	1	—	2	—	3	2	2	—	1	2	2	—	4	—	1	2	5	1	2	2
Rural districts	—	—	—	—	—	—	—	—	—	—	2	—	—	1	2	1	1	1	3	—
North IV	5	1	5	4	3	5	13	—	16	5	21	5	23	4	13	6	17	7	28	12
County Boroughs	2	1	2	4	3	2	8	—	12	4	15	4	17	2	10	5	10	4	19	7
Other urban districts ...	2	—	2	—	—	3	4	—	3	1	6	1	5	2	3	1	7	2	9	3
Rural districts	1	—	1	—	—	—	1	—	1	—	—	—	1	—	—	—	—	1	—	2

* Including one case notified in Port Health Districts.

TABLE 4—*continued.*

Week ended:—	10th June		17th June		24th June		1st July		8th July		15th July		22nd July		29th July		5th August		12th August	
	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-Paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic	Paralytic	Non-paralytic
Midland I	30	8	38	1	62	10	63	16	63	17	62	21	70	22	79	36	75	36	68	22
County Boroughs	21	3	29	—	47	3	38	8	42	4	31	9	41	7	53	15	40	24	39	10
Other urban districts ...	9	4	8	1	13	6	24	6	19	12	23	10	22	12	17	18	22	10	22	6
Rural districts	—	1	1	—	2	1	1	2	2	1	8	2	7	3	9	3	13	2	7	6
Midland II	1	—	3	1	4	1	5	—	4	3	8	5	7	9	15	13	13	2	10	8
County Boroughs	—	—	—	—	1	—	4	—	3	2	4	5	3	4	9	8	6	1	5	3
Other urban districts ...	1	—	3	1	2	1	1	—	—	—	2	—	1	2	5	3	3	1	4	1
Rural districts	—	—	—	—	1	—	—	—	1	1	2	—	3	3	1	2	4	—	1	4
East	2	2	4	—	4	1	3	1	1	1	2	4	7	3	4	5	25	4	15	17
County Boroughs	—	—	—	—	1	—	—	—	1	1	—	—	1	1	1	—	5	1	5	1
Other urban districts ...	1	—	2	—	—	—	2	—	—	—	2	1	4	—	2	—	4	—	1	2
Rural districts	1	2	2	—	3	1	1	1	—	—	—	3	2	2	1	5	16	3	9	14
South West	2	—	1	2	2	3	1	1	3	5	3	—	6	1	5	2	6	2	11	3
County Boroughs	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	1	—	—
Other urban districts ...	1	—	1	1	—	2	1	—	2	3	1	—	4	—	1	1	3	1	9	3
Rural districts	1	—	—	1	2	1	—	1	—	2	2	—	2	1	3	1	3	—	2	—
Wales I	—	—	1	1	3	1	6	—	6	9	4	5	3	1	6	2	7	4	11	4
County Boroughs	—	—	1	—	1	—	2	—	2	—	—	1	—	1	2	—	2	4	3	3
Other urban districts ...	—	—	—	—	2	1	3	—	1	5	4	—	2	—	3	2	5	—	5	1
Rural districts	—	—	—	1	—	—	1	—	3	4	—	4	1	—	1	—	—	—	3	—
Wales II†...	—	—	—	—	—	—	—	—	3	2	2	—	2	—	—	1	6	1	10	2
Other urban districts ...	—	—	—	—	—	—	—	—	2	2	2	—	1	—	—	—	5	1	5	1
Rural districts	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	1	1	—	5	1

† No County Boroughs in this region.

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MORTALITY FROM PINK DISEASE IN 1923-47

WILLIAM P. D. LOGAN
M.D., B.Sc. Glasg., D.P.H.
From the General Register Office

INTEREST in this relatively rare and ætiologically obscure disease of childhood has been stimulated by the suggestion of Warkany and Hubbard [1] that mercury administered in teething powders or in ointments may be the causal agent; out of 20 cases of pink disease mercury was found in the urine of 18. It may be opportune, therefore, to review the mortality of pink disease in England and Wales during the past twenty-five years.

The synonyms for pink disease include erythrœdema, erythrœdema polyneuritica, dermato-polyneuritis, and acrodynia, but their use on death certificates is being steadily given up in favour of the simpler name.

Table I gives the number of deaths and the death-rate from pink disease in each year from 1923 to 1947, and fig. 1 illustrates the trend of the death-rate over those years.

Starting with 1 death in 1923 (a rate of 0·3 per million) the recorded deaths and the death-rate progressively increased, as the disease became more widely recognised, up to 1936, when there were 88 deaths (31·4 per million). For the next three years the numbers fluctuated, dropped to a much lower level in 1940 (49 deaths, 17·0 per million), and remained practically constant at this lower level during the next six years. It is difficult to believe that this was a chance sequence, and it cannot be explained by changes in the birth-rate, which behaved dissimilarly. In 1947, however, deaths rose sharply; the number (103) was the highest yet recorded, and the death-rate (29·2 per million) was almost as high as in 1936. The figures, it should be noted, have not been corrected for the changes in classification that came into force in 1940. But application of the appropriate conversion factor would only partially reduce the drop in 1940 and would not materially alter the picture.

1. Warkany, J., Hubbard, D. M. *Lancet*, 1948, i, 829.

TABLE I—ANNUAL DEATHS BY SEX AND AGE, AND ANNUAL DEATH-RATES (ALL AGES), PER MILLION CHILDREN AGED UNDER 5 YEARS, IN ENGLAND AND WALES IN 1923–47

Years	Annual deaths								Annual death-rate*		
	Male				Female				All ages		
	Age (yr.)			All ages	Age (yr.)			All ages	Both sexes (all ages)	Male	Female	Both sexes
	0–	1–	5–		0–	1–	5–					
1923	..	..	..	..	..	1	..	1	1	..	0·6	0·3
1924	..	1	..	1	..	3	..	3	4	0·5	1·6	1·1
1925	3	..	..	3	1	4	..	5	8	1·7	2·9	2·3
1926	6	4	1	11	5	4	..	9	20	6·4	5·4	5·9
1927	3	3	..	6	8	6	..	14	20	3·6	8·6	6·1
1928	5	8	..	13	4	4	..	8	21	8·1	5·1	6·6
1929	11	5	..	16	8	4	..	12	28	10·2	7·8	9·0
1930	14	5	..	19	8	6	..	14	33	12·3	9·3	10·8
1931	7	6	1	14	13	6	..	19	33	9·2	12·8	11·0
1932	15	10	2	27	5	11	..	16	43	18·0	10·9	14·5
1933	18	11	..	29	14	11	..	25	54	19·5	17·3	18·4
1934	23	10	..	33	18	8	..	26	59	22·6	18·3	20·5
1935	21	13	..	34	18	7	1	26	60	23·6	18·6	21·2
1936	23	14	..	37	24	26	1	51	88	26·0	37·0	31·4
1937	15	11	..	26	28	19	..	47	73	18·3	34·3	26·1
1938	24	18	..	42	24	15	..	39	81	29·3	28·2	28·7
1939	18	9	..	27	24	16	2	42	69	18·5	29·9	24·1
1940	12	11	..	23	13	13	..	26	49	15·7	18·4	17·0
1941	16	6	..	22	12	13	..	25	47	15·2	17·9	16·5
1942	18	10	..	28	12	10	..	22	50	19·2	15·7	17·5
1943	17	3	..	20	18	11	..	29	49	13·4	20·3	16·8
1944	17	11	..	28	15	7	..	22	50	18·2	14·9	16·5
1945	15	8	1	24	16	8	..	24	48	15·0	15·7	15·3
1946	13	6	..	19	22	7	..	29	48	11·4	18·3	14·7
1947	43	15	..	58	32	13	..	45	103	32·0	26·1	29·1

* Though 9 deaths are included at ages 5–10, these death-rates were calculated on the basis of the 0–5 age-group populations, a course which was considered more appropriate here than to exclude the 9 deaths or to base the rates on the 0–10 age-group populations.

The association here revealed between the mortality of pink disease and the war may or may not indicate a real temporary change in the behaviour of the disease. The circumstances of war may have altered the standard of death certification of pink disease; or may have reduced its prevalence or fatality.

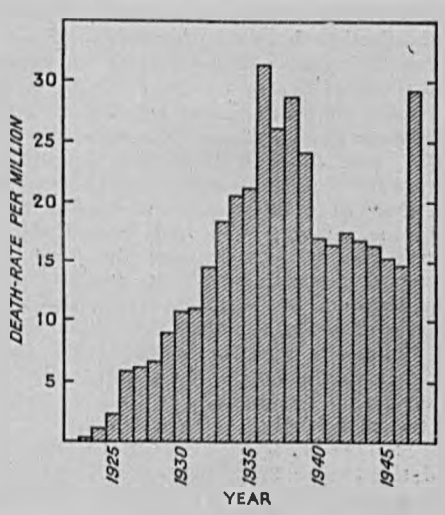

Fig. 1—Annual death-rates from pink disease per million children under 5 years of age in England and Wales in 1923-47.

As table I shows, variations in the predominating sex occurred randomly from year to year. In numbers of deaths each sex predominated in twelve of the twenty-five years, whereas in 1945 the deaths were divided equally between the sexes. The female death-rate exceeded the male in thirteen years. Table II shows that, aggregating years 1923–47, there was no significant difference between the sexes: 49·2% of deaths in males, and 50·8% in females. The percentage for each sex differs from expectation (the 25-year average proportion of each sex in the child population: males 50·8% and females 49·2%) by 1·6%, with a standard error of 1·5%.

Most deaths occurred under the age of 1 year, and none over the age of 9 years. In four of the earlier years (1923, 1924, 1928, and 1932) deaths at ages over 1 year were more numerous than those under 1 year; but after 1932 the lowest age-group has persistently shown an excess ranging from 7 to 32, except in 1940, when the excess was only 1 death.

Table II shows that, of all the deaths in 1923–47, about 61% were in children under 1 year, 38% at

TABLE II—DISTRIBUTION OF DEATHS IN ENGLAND AND WALES IN 1923–47, BY SEX AND AGE

Age (yr.)	Male	Female	Both sexes
0– ..	357	342	699 (*61·4%*)
1– ..	198	233	431 (*37·8%*)
5– ..	5	4	9 (*0·8%*)
All ages ..	560 (*49·2%*)	579 (*50·8%*)	1139 (*100%*)

TABLE III—DEATHS (FOR COMBINED SEXES) AT AGES UNDER 1 YEAR AND UNDER 5 YEARS IN ENGLAND AND WALES, 1940–46

(*a*) Under 1 year

Age	Under 4 weeks	4 weeks to 3 months	3–6 months	6–12 months	Total under 1 yr.
No. of deaths ..	2	4	26	184	216
Per cent. of total	0·9%	1·9%	12·0%	85·2%	100%

(*b*) Under 5 years

Age (yr.)	0–	1–	2–	3–	4–	Total under 5 yr.
No. of deaths ..	216	113	8	3	Nil	340
Per cent. of total	63·5%	33·2%	2·4%	0·9%	Nil	100%

ages 1–4 years, and less than 1% at 5 years of age or over. There was no significant difference in age-distribution between the sexes ($\chi^2 = 2{\cdot}63$, $P > 10\%$). For the years 1940–46 table III provides a further analysis of deaths by age: 63·5% of all deaths under 5 years were in children aged under 1 year, and 33·2% between 1 and 2 years. Among deaths under 1 year over 85% took place in the second 6 months of life. There were few deaths under 6 months or over 2 years of age.

Discussing the age-distribution of morbidity in pink disease, Fisher,[2] who had formed the impression that with the passage of time the "age of attack" was becoming lower, found, on analysis of his figures, no evidence of any significant age-shift. In our present series of deaths, on the other hand, there is evidence of a significant age-shift between 1923 and 1947 from the higher to the lowest age-group. (By Spearman's rank correlation technique, $\rho = 0{\cdot}63$, significant by Student's *t* test at a level of between 0·1%.)

The deaths, aggregated for the years 1940–46, in each of the twelve main regions of England and Wales are contained in table IV. In the absence of information about regional populations at ages during the war years, total live births in each region, aggregated for the same years, have been used as a base for the calculation of "death-rates." Such rates, it should be noted, do not take account of migrational movements of the child population during the war.

2. Fisher, T. N. *Brit. med. J.* 1947, i, 251.

TABLE IV—REGIONAL DISTRIBUTION OF DEATHS IN 1940–46 AND IN 1947, AND REGIONAL DEATH-RATES PER MILLION LIVE BIRTHS IN 1940–46, IN ENGLAND AND WALES

Region*	Number of deaths, 1940–46							Death-rate (per million live births), 1940–46, both sexes, all ages	No. of deaths (both sexes, all ages), 1947
	Male Age (yr.)			Female Age (yr.)			Both sexes (all ages)		
	0–	1–	5–	0–	1–	5–			
Greater London ..	7	7	..	9	11	..	34	40·9 ± 7·0	5
Remainder of S.E.	4	11	..	6	5	..	26	38·3 ± 7·5	8
North I	20	4	..	18	12	..	54	201·4 ± 27·4	10
North II	3	..	..	2	3	..	8	51·2 ± 18·1	4
North III	15	8	..	18	5	..	46	114·3 ± 16·9	14
North IV	18	12	1	16	9	..	56	78·8 ± 10·5	22
Midland I	19	4	..	8	11	..	42	65·8 ± 10·2	17
Midland II	10	5	..	14	1	..	30	95·5 ± 17·4	7
East	7	1	..	6	2	..	16	71·4 ± 17·9	3
South-west ..	..	..	..	2	4	..	6	24·1 ± 9·8	7
Wales I	2	1	..	6	1	..	10	45·6 ± 14·4	5
Wales II	3	2	..	3	5	..	13	158·7 ± 44·0	1
England and Wales	108	55	1	108	69	..	341	71·4 ± 3·9	103

* For the geographical constitution of the regions, see the Registrar-General's Statistical Review (any recent year).

There are highly significant differences between the rates in the twelve regions ($\chi^2 = 117{\cdot}89$. $P < 0{\cdot}0001\%$). The highest rate was recorded in North I (201·4 per million), followed by Wales II (158·7) and North III (114·3). The lowest rate occurred in the South-west region (24·1), followed by the South-east (38·3), and then by Greater London (40·9). These regional differences are illustrated, and may be compared region with region, in fig. 2.

The regional distribution of deaths in 1947 is shown in the last column of table IV. It will be seen that the large increase in deaths during that year was not concentrated in any one part of the country but was shared among the regions in about the same proportions as in previous years.

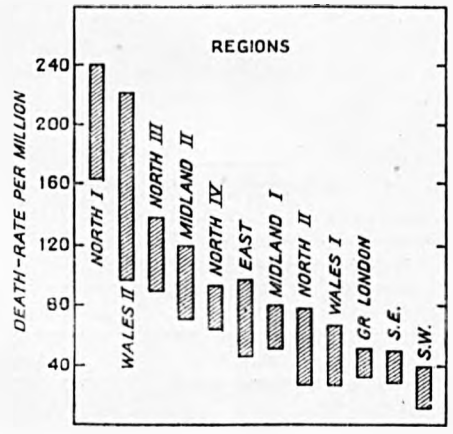

Fig. 2—Regional death-rates from pink disease per million live births in 1940–46, with abbreviated confidence intervals to test whether differences are 5% significant.

Method of Construction

The abbreviated confidence interval technique has been devised by a statistician of the General Register Office. The abbreviated intervals are obtained by reducing, in the proportion $1 : \sqrt{2}$, the confidence intervals of Neyman.

The diagram provides a useful approximation to the results that would be obtained by carrying out 66 tests of significance to compare each possible pair of regions. Before using this technique it is essential, as has been done here, first to establish a significant general heterogeneity of the regions by means of a χ^2 or other equivalent test.

Method of Use

Note whether the rectangles representing any chosen pair of regions overlap on the vertical scale. If they overlap—e.g., North III and East—there is no significant difference between the two regions. If they do not overlap—e.g., North III and Midland I—there is a significant difference between them.

A significant difference can be taken as one which is more than twice its standard error, and this criterion of significance was adopted in constructing the diagram.

It is conjectural whether these differences in death-rate between the regions are due to differences in morbidity, in fatality, or in standards of diagnosis. It would be interesting to know whether there exist regional differences of habit in the administration of mercurial medicaments to young children.

SUMMARY

The death-rate of pink disease fell to a constant low level during the late war but rose sharply in 1947.

There was no significant difference in sex-mortality over the years 1923–47.

About two-thirds of the deaths were in children aged under 1 year, especially at ages 6–12 months. Of the other third practically all were between the age of 1 and 2 years.

During 1940–46 there were highly significant differences between regional death-rates.

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SOME RECENT DEVELOPMENTS IN HEALTH STATISTICS — INTERNATIONAL, NATIONAL AND LOCAL*

By W. P. D. LOGAN, B.SC., M.D., D.P.H.,
Medical Statistician, General Register Office

International Health Statistics

In the international field one of the most important events in recent years, so far as health statistics are concerned, has been the Sixth Revision of the International List of Causes of Death. Though still following the general pattern of its predecessors, the new list has been expanded to provide adequate details of *all* diseases and injuries, not just those likely to lead to death. It thus provides a classification intended for use not only for mortality but for morbidity purposes. Indicative of its wider scope, the list has been given the new title "The International Statistical Classification of Diseases, Injuries and Causes of Death."[1]

The history behind the creation of the original International List in 1893 began 40 years earlier when in 1853 Dr. William Farr, of the General Register Office, indicated to an international conference the lines on which an international classification should be constructed.

The International List that came into existence in 1893 was based on those principles that Farr had previously laid down. It underwent periodic revision at Decennial Conferences convened by the Government of France in 1900, 1909, 1920, 1929 and 1938. The Sixth Revision Conference in 1948 which, it has been justly claimed, marked the beginning of a new era in international vital and health statistics, was the last to be convened by the French Government, and responsibility for the future supervision of the list has now been entrusted to the World Health Organization. That this should be one of the duties of W.H.O. was something that we in the United Kingdom had pressed for strongly, convinced that in this course lay the best prospects for the future success of the new List. Health statistics, their international comparability and the instruments by which that comparability was to be achieved were, in our opinion, proper interests of an international organisation such as W.H.O. The new List was designed for the use not just of vital statisticians but of *all* workers in the medical field, and it was appropriate that it should be brought under the aegis of an organisation in which statisticians foregather with clinicians, sanitarians, epidemiologists, and the many other experts concerned with international health in all its aspects.

So much, then, for the history of the International List. There is a detailed account in the introduction to Volume I of the new Manual; and in the recent International Health number of the *British Medical Journal* there was an article by Dr. Percy Stocks[2] who, as Chairman of the Expert Committee that drafted the new List, has done as much as anyone in the world to bring it into being and to make it the good piece of work it is.

The new Classification has rendered obsolete the Provisional Morbidity Classification[3] published by the Medical Research Council in 1944, and this has now gone out of official use. The Provisional Morbidity Classification fulfilled a necessary function during and shortly after the war in connection with hospital and other statistics of illness and injury, and the experience gained from using it served well in guiding the compilers of the new List, especially as Dr. Stocks and Dr. Robb-Smith took part in preparing both lists. I should add that the Therapeutic Classification (*i.e.* the Operations List) that was contained in this M.R.C. Manual has not yet been replaced, though the Registrar General's Advisory Committee have in hand the preparation of a new Operations List. Furthermore, the M.R.C. Manual included a short version of the 1931 Occupational Classification. This, too, has not yet been replaced though it will be soon; a new Occupational Classification will be published later this year.

In addition to the M.R.C. Morbidity Classification, there is another important list of diseases to which I must refer and which has *not* been made obsolete by the new list. It is the Nomenclature of Disease[4] of the Royal College of Physicians, the latest edition of which came out in 1948. Despite the fact that there is a clear-cut difference between a nomenclature and a statistical classification, the two are frequently confused even by those who ought to know better. Each is designed for its own specific purpose and the one cannot replace the other. A medical nomenclature is a list of approved terms for describing and recording clinical and pathological observations. It gives what is considered to be the most desirable name for every disease, symptom, or pathological condition. For instance, there are at least three fairly well-known synonyms for pink disease—acrodynia, erythroedema polyneuritica, and Swift's disease, but if you consult the Royal College of Physicians Nomenclature you will find that "pink disease" is the approved name though erythroedema may be used as an alternative. A statistical classification, on the other hand, is not concerned with what a disease ought to be called—though it is a help in disease classification if well-known and accepted terms are used instead of unusual ones—but with providing convenient groups into which various morbid conditions can be placed that have some kind of affinity with each other so that they can be counted or discussed in a manageable way. For instance all the clinical and bacteriological varieties of diphtheria are lumped together in the Statistical Classification under the one heading "055 Diphtheria." A nomenclature tells you what name you ought to call a disease by; a statistical classification tells you into what group it ought to go.

So far as the actual content of the new List is concerned I propose to say little. You have all seen it, I expect, and you will have some idea of its general structure and of what it contains. There are just one or two special features to which I should like to draw attention.

The first is the Injuries Section, which has been greatly enlarged and now contains a double classification, by the *external cause* of the injury (*e.g.* run over by a van) and by the *nature* of the injury (*e.g.* compound fracture of the femur).

A second feature is that, in addition to the full list of some 800 categories, there is an intermediate list of 150 categories. Also two short lists are suggested, each of 50 categories, one intended for mortality and the second for morbidity classification of social insurance data. Short lists for other kinds of morbidity data will be suggested when some experience has been gained. Although there are these abbreviated lists, it is always advisable to code to the full detailed list in the first instance and reduce the tabulations to one of the shorter lists afterwards if desired. If coding is done directly by a short list, no transformation from that list is practicable afterwards, but if detailed coding is done to start with, all things are then possible.

The last point to which I want to draw attention is the Index, which constitutes Volume II of the Manual and contains something like 30,000 entries. This very comprehensive Index will make it much easier for coders to work with the Classification.

These, then, are a few points about the new List. It will be used by the General Register Office for all its morbidity and mortality tabulations from 1950 onwards. It has been agreed that it will be used by all Government Departments in this country that are concerned with health statistics—the Ministries of Health, National Insurance, and so on—and by the three

* Paper presented to the annual meeting of the County Borough Medical Officers of Health Group, Society of M.O.H., Scarborough, June 3rd, 1950.

branches of the armed forces. Moreover, it will be used by all the member states of the World Health Organization so that practically all the countries that publish mortality statistics will soon be doing so in a form that allows a much better comparison between one country's figures and another's. An agreed classification is not by any means the only thing needed for internationally comparable statistics, but it is a very necessary first step.

A further necessary step has been taken by the international adoption of a standard form of medical certificate of cause of death, a form which differs only very slightly from the one that was already in use in England and Wales. The actual layout of the death certificate may not, on the face of things, seem a very important matter compared with what is actually certified on it but, in fact, unless a standard form of certificate is used, there can be little prospect of obtaining reasonably comparable statistics.

Agreement has also been reached on the method of selecting one cause of death for assignment when more than one cause has been mentioned on the death certificate. The method that we adopted in 1940, whereby the certifying practitioner, by his order of statement, indicates which should be regarded as the underlying cause of death, has now been adopted internationally. As a result the deaths in each country assigned say to diabetes will be those thought *due* to diabetes, not the deaths of diabetics, a very different matter.

The international comparability of health statistics is an objective well worth striving for, not only in order that the activities of the World Health Organization shall be guided by fact rather than by conjecture but so that each country can have a set of standards with which to compare its own experience. Shortcomings and deficiencies will thus be revealed, complacency destroyed, corrective action stimulated and the results of such action measured; and we in the United Kingdom will gain from these comparisons no less than other countries throughout the world.

Turning now from the International Classification but still within the field of international health statistics, a second achievement of great significance has been the appointment by the World Health Organization of an Expert Committee entrusted with the study of problems connected with health statistics. This Expert Committee meets once a year—its second annual meeting was in April of this year—and it, together with its sub-committees, has been engaged on the problems of the definitions of stillbirth and abortion, schemes for the registration and follow-up of patients suffering from cancer, and methods of collecting hospital statistics. Another matter to which some attention has been paid has been the training of undergraduate medical students and of public health students in the methods of statistical presentation and analysis.

The World Health Organization has recognised the imperative need for sound health statistics and, in consequence of the importance that it attaches to the matter, has set up a separate Health Statistics Division within its Secretariat. This Division works in very close collaboration with the Division of Epidemiology, the two Divisions formerly constituting the Division of Epidemiology and Public Health Statistics.

National Health Statistics

Under this heading I want to refer briefly to some of the morbidity studies that have been initiated recently, confining my attention to those studies that are being dealt with by the General Register Office.

(1) *Hospital Statistics.*—Under the title of the National Morbidity Enquiry arrangements have been in operation since the beginning of 1949 whereby all the general teaching hospitals in England and Wales and all the hospitals in the City of Manchester and the County of Leicester send us a summary record of their in-patients with a statement of diagnosis and complications. A special questionnaire is completed in respect of patients admitted on account of injuries.

During 1949 we received about 300,000 summary records. These are now being analysed, and we shall be publishing some interesting and, let us hope, instructive tabulations in the near future. On account of their highly selective nature, hospital statistics by themselves will be of only limited value as indices of the total incidence of different diseases in the population though variations in admissions from month to month will shed some light on seasonal variations in prevalence. What the records will show, however, will be disease patterns in relation to sex, age and occupation, the frequency of certain complications and sequelae, and the frequency of certain types of injury in relation to various kinds of accident. All this will be information well worth having.

Other hospital statistics that are also being collected concern the mental hospitals and the mental deficiency institutions. Before long we hope to provide a great deal more information than has so far been available about the patients in these institutions, their social background, family history and so on, and the type of mental disorder from which they are suffering.

(2) *Survey of Sickness.*—As an index of the general state of the public health from month to month and from year to year the Survey of Sickness has been serving a valuable purpose ever since it began in 1943. Originally introduced so that the Government should have knowledge of any worsening of the health of the people under the stresses of war—black-out, food rationing, long hours of work, and so on—it has been continued since the war because it fills a gap in our knowledge of sickness incidence that cannot be readily filled in any other way. Hospital records cannot give a complete picture of sickness, since only a small proportion of people who are ill go into hospital; doctors' records, too, fail to tell the whole story since less than a third of the illnesses of which people complain cause them to go and see their doctor. Without some kind of survey it would be impossible to collect information about the majority of illnesses from which people suffer.

It has sometimes been suggested that the Survey of Sickness statistics must be accepted with great caution because they are based only on what the patient himself remembers and is prepared or is able to tell about his recent illnesses. Nevertheless, they have stood up well to all the tests that have been applied to them—for instance, comparison with Ministry of Food statistics of the incidence of diseases qualifying for special diets[5] —and for my own part I am fully satisfied that the Survey of Sickness does in fact provide reliable indices of sickness. Especially is this so in regard to variations from month to month in the prevalence of sickness, days of incapacity and visits by or to doctors, in regard to the broad diagnostic picture of the causes of illness, and in regard to differences among people by sex, age, occupation and income. The Survey method has certain limitations, of course. The data provided about the incidence of cancer, for instance, are almost certainly unreliable; so, too, I should imagine, are those in regard to conditions like venereal infections, chronic alcoholism and induced abortion; for such conditions some other method of ascertainment would have to be employed. It has never been claimed for the Survey of Sickness that it is the only way to collect morbidity data; sickness being as common as it is there will never be an only way. It is one way among several; but experience has shown that it is a useful method and that it provides information that cannot be obtained otherwise.

(3) *Cancer Registration and Follow-up.*—To fill the gap in our knowledge about the incidence of cancer—by that I mean all malignant neoplasms, not just the carcinomata—and to gauge the effectiveness of different methods of treatment, a system of cancer registration on a national scale was started in 1945, and last year (1949) some 50,000 new cases of cancer were registered at the General Register Office. By following up these registered cases for five years a great deal will be learnt about the survival of cancer patients and about the numbers who apparently recover under different forms of treatment. At present there is a bias among our registered cases towards patients treated by radio-therapy because the registration scheme was originally introduced under the auspices of the Radium Commission. Within a year or two, however, the surgically treated cases will be more fully represented and we shall have a fairly complete picture of diagnosed cancer in England and Wales.

(4) *The Notifiable Infectious Diseases.*—The General Register Office has been publishing statistics of infectious disease since 1893. A recent innovation of very great value has been the quarterly corrections of diagnosis and the age analyses that we

have been receiving from Medical Officers of Health since 1944. We now have over five years' data and it is becoming possible, as it has never been before, to see the national sex-age pattern of morbidity, as distinct from mortality, of the notified infections.

With regard to tuberculosis—medical officers of health are still, I hope, interested in tuberculosis—an extensive analysis of notifications for the years 1938–48 is now practically complete and will be published shortly.

We have recently started to consider how much statistical information can be got from the records of mass miniature radiography, and in the near future we shall be embarking upon an intensive analysis of these potentially valuable records. It is too soon yet to risk any prophecies about what is likely to emerge, but one matter on which we hope to get some further facts is the relationship between tuberculosis morbidity and particular occupations. We have also been considering the practicability of following up positive cases for a year or two to find out what has in fact happened to them after the miniature film has given the warning that something is wrong; so far, however, this is only an idea and the details have yet to be worked out.

Local Health Statistics

Medical Officers of Health have been told, and have been telling one another, quite frequently in the past two years, that the loss of several of their former responsibilities is an advantage in that it gives them opportunities that they lacked before "to study all the morbid conditions contributing to a high sickness rate or mortality in their area with a view to their prevention and control."[6] Whether or not there will be a flood of new epidemiological research from local areas I do not know—I am referring here to "general" epidemiology, not just the epidemiology of the infectious diseases—but if there is, it may well prove to be not the least profitable result of the National Health Service.

There are several good reasons why field epidemiological research by Medical Officers of Health should be of particular value. Three of these reasons are:—

(1) The variations of the social and environmental indices are often much wider *within* individual local areas, especially large towns, than *between* these towns, so that influences that are obscured when average index values for whole towns are used can be more readily identified.

(2) Although large numbers of cases are useful and sometimes essential if conclusive results are to be obtained, a more important attribute is that the data should be reliable—that what is called measles is in fact measles and not rubella, that what is called peptic ulcer is not cancer of the stomach. The closer, therefore, that the epidemiological research worker can get to his material, the more trustworthy the results ought to be.

(3) The medical officer of health is peculiarly well equipped for epidemiological research. There is, in fact, no one better equipped than he. He has himself received a special training that renders him eminently suitable to organise and to carry out research projects; he is provided with a well-trained staff who are intimately acquainted with their district and everything in it; and in various ways he is able to keep himself informed of important disease trends and fluctuations within his area—perhaps not as well as he would wish, but certainly better than anyone outside.

For these reasons I hope that Medical Officers of Health will seize their opportunity and launch the research programmes that, considering the potential value of such work, have perhaps not been as frequent in the past as they might have been, though of course there have been many notable exceptions. The valuable discussion on Field Epidemiology at this year's Health Congress of the Royal Sanitary Institute[7] should act as a stimulus

At this point may I put in a special plea that in these research programmes into important diseases of every kind, the common infectious diseases should not be pushed aside and forgotten about in the enthusiasm for new pastures? There is much still to be learnt about the epidemiology of measles, whooping cough, scarlet fever and diphtheria and, indeed, of chickenpox, mumps and german measles. The problems of the periodicity of epidemics, the shape of the epidemic curve and the frequency of sub-clinical infections are far from being solved despite the efforts of Brownlee, Greenwood and Stocks, to name only a few. These problems are not purely of academic interest but are of very great practical importance. Some years ago Greenwood[8] expressed the opinion that the solution to these problems would not be found till a more intensive attack could be made by the mathematicians. It may be that Greenwood was right—he often was—but I think it cannot be too strongly emphasised that all the mathematicians in the world will never solve these problems unless they are given dependable data to work upon. It has always seemed to me a pity, to say the least, to perform elaborate mathematical calculations upon data that are incomplete or inaccurate or both.

Well-conducted field research into the epidemiological behaviour of the common fevers can still have great value even though the mortality of most of them is rapidly vanishing. The more we can learn about the habits of the relatively innocuous but very prevalent viruses, such as those of measles, rubella, chickenpox and mumps, the better placed we shall be for attacking the more serious ones such as poliomyelitis. The more we can learn now about influenza, the better we shall cope with the next pandemic. It will not be forgotten that it is now 32 years since the last pandemic, and we should be foolhardy indeed to imagine that the virus of influenza has completely changed its ways. Let us try too to get a clearer understanding of the mechanism of infection by the erythrogenic streptococci of scarlet fever now while they are tame. Some day they may try to become killers again.

Even if for a time these researches produce no startling results, at least they may throw light on the incompleteness of notification, and if, by careful case finding, the ratio of notified to actual cases can be accurately ascertained at different times and in different places, then notification statistics will be given added value. They will cease to be mere indices of trend, important as these are, and become indices of the absolute prevalence of the infectious diseases.

Sydenham[9] thought the way to study the behaviour of a fever was to "choose some large and populous place." Even though we have the notable example of Pickles[10] in recent years to show that Sydenham's directive need not be invariably followed, there are advantages in having a large number of cases for study, provided the study can at the same time be carefully made. It can be difficult, sometimes dangerous, and sometimes impossible to draw conclusions from a limited experience.

Now it may happen that the number of authenticated cases of a particular disease occurring within a reasonable time, even in a "large and populous place" are too few to yield significant results, and sufficient numbers can be obtained only by combining a number of areas and perhaps even all such areas in the country. A problem of this type has cropped up recently in connection with rubella during pregnancy and its tendency to cause congenital defects in the child. The evidence for this association, though highly suggestive, is not completely satisfactory from the statistical point of view, and it has been decided to investigate the matter as thoroughly as possible in order to determine exactly what proportion of "rubella" pregnancies do, in fact, result in congenitally defective children and how this number compares with that from normal pregnancies. As only a few hundred pregnant women in the whole of England and Wales are likely to suffer from rubella in the course of a year, only a nation-wide case-finding campaign covering practically all the expectant mothers in the country, together with an adequate number of controls, can be expected to yield a sufficiency of cases. An enquiry, in which the opportunity will also be taken to investigate the possible effects of chickenpox, measles, mumps and poliomyelitis has been initiated by the Ministry of Health and the central statistical work is being done by the General Register Office. With the support and approval of the Society of Medical Officers of Health, the Medical Officers of Health of all the Local Health Authorities have been asked to co-operate in the enquiry, this being considered the best way—perhaps the only way—of achieving the two requisites of adequate numbers and highly accurate records kept in accordance with a uniform plan.

Why I am especially interested in this enquiry is because it is, I believe, the first *ad hoc* statistical investigation, at any rate in recent years, in which the General Register Office and Medical Officers of Health have collaborated in this way, the former acting as the central statistical bureau and the latter supervising and co-ordinating the collection of data in the field. The opportunity of associating with Medical Officers of Health in this enquiry has been warmly welcomed by my Department, and I hope that further opportunities of a similar nature will arise in the future. It is not difficult to think of other pressing problems that can best or can only be solved by carefully co-ordinated enquiries on a nation-wide scale, and for such purposes the General Register Office and the Medical Officers of Health can constitute a powerful and effective combination.

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POLIOMYELITIS, 1949

PRELIMINARY OBSERVATIONS

W. P. D. LOGAN
M.D., B.Sc. Glasg., D.P.H.
MEDICAL STATISTICIAN, GENERAL REGISTER OFFICE

NOTIFICATIONS of poliomyelitis in England and Wales during 1949 (up to Nov. 12) reached their maximum in the middle of October, more than a month later than in the epidemic of 1947. Though the weekly notifications are now diminishing, it will be some weeks before the 1949 epidemic can be seen as a whole. Meanwhile, however, it is possible to study some aspects of the first part of the epidemic and to make comparisons with 1947.

The general shape of the curves of the two epidemics —1947, and 1949 so far as it has gone—should be already familiar to readers from the chart published from time to time in THE LANCET (see p. 1009). It is unnecessary therefore to discuss in detail differences between the general trend of the disease in the two epidemics. Instead, attention will be directed towards sex, age, and regional variations in numbers of notified cases and of deaths.

Table I shows the numbers of original and corrected notifications and corrected notification-rates in the main geographical regions during the September quarters (July, August, September) of 1947 and 1949. In 1947 the region with the highest rate was North II (Cumberland, Westmorland, and the East and North Ridings of Yorkshire), while the lowest was the South-West (Cornwall,

TABLE I—ORIGINAL AND CORRECTED NOTIFICATIONS OF ACUTE POLIOMYELITIS (INCLUDING ACUTE POLIOENCEPHALITIS) IN SEPTEMBER QUARTERS, 1947 AND 1949 (NON-CIVILIANS EXCLUDED); AND CORRECTED NOTIFICATIONS PER MILLION LIVING AND AS A PERCENTAGE OF ORIGINAL NOTIFICATIONS. ENGLAND AND WALES, REGIONS, AND DENSITY AGGREGATES

Area	September quarter, 1947				September quarter, 1949			
	Original notifications	Corrected notifications	Annual rate per million living	Corrected as % of original notifications	Original notifications	Corrected notifications	Annual rate per million living	Corrected as % of original notifications
ENGLAND AND WALES	6407	5298	503	83	3108	2645	245	85
South-East	2487	2009	557	81	1283	1131	306	88
Greater London	1594	1203	590	75	767	639	306	83
Remainder of South-East	893	806	514	90	516	492	305	95
North	2199	1850	559	84	863	701	207	81
North I	481	411	745	85	107	83	147	78
,, II	287	279	848	97	49	44	130	90
,, III	619	539	614	87	357	306	343	86
,, IV	812	621	400	76	350	268	169	77
Midland	980	803	413	82	448	364	183	81
Midland I	715	566	439	79	245	184	140	75
,, II	265	237	361	89	203	180	269	89
East	260	226	472	87	133	112	228	84
South-West	188	168	301	89	278	252	443	91
Wales	293	242	384	83	103	85	132	83
Wales I	234	184	408	79	90	72	156	80
,, II	59	58	324	98	13	13	71	100
County boroughs } outside	1781	1370	429	77	868	694	212	80
Other urban district } Greater	1794	1599	477	89	892	787	230	88
Rural districts } London	1238	1126	579	91	581	525	263	90

Devon, Dorset, Somerset, and Wiltshire). In 1949 the South-West had the highest rate, while North II was second lowest, the lowest being Wales II (North Wales). There was, however, no general tendency for regions with high rates in 1947 to have low rates in 1949 or vice versa. For instance, the South-East had relatively high rates and Wales relatively low rates in both years.

Considering now the density aggregates (bottom of table I), in both years the rates were lowest in county boroughs and highest in rural districts, but the relative difference between these two types of area was rather less in 1949 than in 1947.

The two columns of table I which express corrected notifications as a percentage of original notifications indicate considerable differences in this respect between different areas. For the country as a whole, the effect of correction was practically equal in the two years—83% in 1947 and 85% in 1949. In both years the effect of correction was less apparent in rural areas than in towns, suggesting either that the accuracy of original diagnosis was greater in the country districts than in the towns, which seems unlikely, or that less effort was made in country areas to report amendments of diagnosis; a third possibility is that in country districts amendments of diagnosis to and from poliomyelitis more nearly balanced one another than in the towns.

Table II provides a two-way analysis of original notifications during June–October in each of the two years by main regions and by type of area. The experience in the two epidemics is compared by the percentages shown in the right hand section of the table, no account being taken of possible population changes in the two years. For the country as a whole, notifications in 1949 during the 22-week period were 40% fewer than during the corresponding weeks of 1947, this proportion being approximately maintained in each of the three density aggregates. An outstanding departure from this level occurred in the South-West, where there were 1½ times as many notifications in 1949 as in 1947, the excess being greatest (89%) in the urban districts. By contrast, notifications in the rural districts of Wales in 1949 were only a fifth of those two years before.

In all the tables cases of polioencephalitis have been included with poliomyelitis. The second footnote to

TABLE II—ORIGINAL NOTIFICATIONS OF ACUTE POLIOMYELITIS (INCLUDING ACUTE POLIOENCEPHALITIS) IN JUNE TO OCTOBER, 1947 AND 1949 (INCLUDING NON-CIVILIANS); AND NOTIFICATIONS IN 1949 AS A PERCENTAGE OF THOSE IN 1947. ENGLAND AND WALES, REGIONS, AND DENSITY AGGREGATES

Area	June–October, 1947 (22 weeks)				June–October, 1949 (22 weeks)				1949 as percentage of 1947			
	C.Bs.	U.Ds.	R.Ds.	Total	C.Bs.	U.Ds.	R.Ds.	Total	C.Bs.	U.Ds.	R.Ds.	Total
ENGLAND AND WALES	2387	4190	1601	8178	1355	2628	906	4889	57	63	57	60
South-East	280	2426	415	3121	199	1600	324	2123	71	66	78	68
North	1293	1042	469	2804	673	461	162	1296	52	44	35	46
Midland	652	354	284	1290	364	209	133	706	56	59	47	55
East	71	100	171	342	46	86	93	225	65	86	54	66
South-West	30	106	134	270	43	200	168	411	143	189	125	152
Wales	61	162	128	351	30	72	26	128	49	44	20	36

Notifications in port health districts were: 1947, 9; 1949, 13.
Notifications of acute polioencephalitis as a percentage of those of acute poliomyelitis were:

	1947	1949
County boroughs	3·6	6·5
Other urban districts	8·9	9·1
Rural districts	10·3	8·6
Total	7·6	8·3

TABLE IV (*a*)—CORRECTED NOTIFICATIONS OF ACUTE POLIOMYELITIS (INCLUDING ACUTE POLIOENCEPHALITIS) IN QUARTER ENDED SEPT. 30, 1947, BY SEX AND AGE WITH EACH AGE-GROUP AS A PERCENTAGE OF ALL AGES. ENGLAND AND WALES, REGIONS, AND DENSITY AGGREGATES (INCLUDING NON-CIVILIANS)

Area	MALES									FEMALES								
	All ages	0–	1–	3–	5–	10–	15–	25 and over	Not stated	All ages	0–	1–	3–	5–	10–	15–	25 and over	Not stated
ENGLAND AND WALES																		
Number	3030	111	446	397	638	468	497	433	40	2357	96	338	302	435	331	401	431	23
% of all ages ..	*100*	*4*	*15*	*13*	*21*	*15*	*17*	*14*	*1*	*100*	*4*	*14*	*13*	*19*	*14*	*17*	*18*	*1*
South-East																		
Number	1171	47	121	137	283	198	186	192	7	865	30	79	90	166	131	194	171	4
% of all ages ..	*100*	*4*	*10*	*12*	*24*	*17*	*16*	*16*	*1*	*100*	*3*	*9*	*10*	*20*	*15*	*23*	*20*	*0*
Greater London																		
Number.. ..	670	32	70	91	168	114	94	100	1	543	18	54	59	103	84	125	100	..
% of all ages ..	*100*	*5*	*10*	*14*	*25*	*17*	*14*	*15*	*0*	*100*	*3*	*10*	*11*	*19*	*15*	*23*	*19*	..
Remainder of S.-E.																		
Number.. ..	501	15	51	46	115	84	92	92	6	322	12	25	31	63	47	69	71	4
% of all ages ..	*100*	*3*	*10*	*9*	*23*	*17*	*19*	*18*	*1*	*100*	*4*	*8*	*10*	*19*	*15*	*21*	*22*	*1*
North																		
Number	999	43	199	163	183	138	155	105	13	873	47	196	132	152	109	94	131	12
% of all ages ..	*100*	*4*	*20*	*16*	*18*	*14*	*16*	*11*	*1*	*100*	*5*	*23*	*15*	*18*	*12*	*11*	*16*	*1*
Midland																		
Number	478	9	72	60	96	66	86	82	7	343	8	36	43	74	50	68	63	1
% of all ages ..	*100*	*2*	*15*	*13*	*20*	*14*	*18*	*17*	*1*	*100*	*2*	*10*	*13*	*22*	*14*	*20*	*18*	*0*
East																		
Number	131	6	7	13	34	27	21	23	..	99	3	8	15	15	20	15	22	1
% of all ages ..	*100*	*5*	*5*	*10*	*26*	*20*	*16*	*18*	..	*100*	*3*	*8*	*15*	*15*	*20*	*15*	*23*	*1*
South-West																		
Number	116	..	17	8	19	24	30	10	8	69	3	2	5	10	9	13	23	4
% of all ages ..	*100*	..	*15*	*7*	*16*	*21*	*25*	*9*	*7*	*100*	*4*	*3*	*7*	*14*	*13*	*19*	*34*	*6*
Wales																		
Number	135	6	30	16	23	15	19	21	5	108	5	17	17	18	12	17	21	1
% of all ages ..	*100*	*4*	*22*	*12*	*17*	*11*	*14*	*16*	*4*	*100*	*5*	*16*	*16*	*16*	*11*	*16*	*19*	*1*
County boroughs*																		
Number	749	27	155	103	146	106	118	91	3	629	29	104	97	112	75	98	113	1
% of all ages ..	*100*	*4*	*21*	*14*	*19*	*14*	*16*	*12*	*0*	*100*	*5*	*16*	*15*	*18*	*12*	*16*	*18*	*0*
Other urban districts*																		
Number	898	33	154	122	184	124	131	132	18	729	34	129	98	128	105	102	121	12
% of all ages ..	*100*	*4*	*17*	*13*	*20*	*14*	*15*	*15*	*2*	*100*	*5*	*18*	*13*	*17*	*14*	*14*	*17*	*2*
Rural districts*																		
Number	713	19	67	81	140	124	154	110	18	456	15	51	48	92	67	76	97	10
% of all ages ..	*100*	*3*	*9*	*11*	*20*	*17*	*22*	*15*	*3*	*100*	*3*	*11*	*11*	*20*	*15*	*17*	*21*	*2*

TABLE IV (*b*)—CORRECTED NOTIFICATIONS OF ACUTE POLIOMYELITIS (INCLUDING ACUTE POLIOENCEPHALITIS) IN QUARTER ENDED SEPT. 30, 1949, BY SEX AND AGE WITH EACH AGE-GROUP AS A PERCENTAGE OF ALL AGES. ENGLAND AND WALES, REGIONS, AND DENSITY AGGREGATES (INCLUDING NON-CIVILIANS)

ENGLAND AND WALES																		
Number	1476	62	257	223	311	187	232	195	9	1191	61	213	176	223	134	184	194	6
% of all ages ..	*100*	*4*	*17*	*15*	*21*	*13*	*16*	*13*	*1*	*100*	*5*	*18*	*15*	*19*	*11*	*15*	*16*	*1*
South-East																		
Number	632	27	112	105	130	81	92	84	1	507	26	87	75	87	66	77	88	1
% of all ages ..	*100*	*4*	*18*	*17*	*20*	*13*	*15*	*13*	*0*	*100*	*5*	*17*	*15*	*17*	*13*	*15*	*18*	*0*
Greater London																		
Number.. ..	356	22	78	55	70	42	43	46	..	285	21	56	45	57	33	34	39	..
% of all ages ..	*100*	*6*	*22*	*15*	*20*	*12*	*12*	*13*	..	*100*	*7*	*19*	*16*	*20*	*12*	*12*	*14*	..
Remainder of S.-E.																		
Number.. ..	276	5	34	50	60	39	49	38	1	222	5	31	30	30	33	43	49	1
% of all ages ..	*100*	*2*	*12*	*18*	*22*	*14*	*18*	*14*	*0*	*100*	*2*	*14*	*14*	*14*	*15*	*19*	*22*	*0*
North																		
Number	381	18	78	46	85	45	62	44	3	324	15	56	58	67	37	40	51	..
% of all ages ..	*100*	*5*	*20*	*12*	*22*	*12*	*6*	*12*	*1*	*100*	*5*	*17*	*18*	*21*	*11*	*12*	*16*	..
Midland																		
Number	215	7	39	36	41	28	41	23	..	156	11	32	21	30	11	30	21	..
% of all ages ..	*100*	*3*	*18*	*17*	*19*	*13*	*19*	*11*	..	*100*	*7*	*21*	*13*	*20*	*7*	*19*	*13*	..
East																		
Number	65	1	4	9	11	13	10	17	..	48	1	7	5	11	6	12	6	..
% of all ages ..	*100*	*2*	*6*	*14*	*17*	*20*	*15*	*26*	..	*100*	*2*	*15*	*10*	*23*	*13*	*24*	*13*	..
South-West																		
Number	137	7	14	20	38	16	22	18	2	117	5	21	10	21	12	20	25	3
% of all ages ..	*100*	*5*	*10*	*15*	*28*	*12*	*16*	*13*	*1*	*100*	*4*	*18*	*9*	*18*	*10*	*17*	*21*	*3*
Wales																		
Number	46	2	10	7	6	4	5	9	3	39	3	10	7	7	2	5	3	2
% of all ages ..	*100*	*4*	*22*	*15*	*13*	*9*	*11*	*19*	*7*	*100*	*8*	*25*	*18*	*18*	*5*	*13*	*8*	*5*
County boroughs*																		
Number	381	18	89	55	70	60	41	45	3	313	16	64	51	55	32	43	52	..
% of all ages ..	*100*	*5*	*23*	*14*	*18*	*16*	*11*	*12*	*1*	*100*	*5*	*20*	*16*	*18*	*10*	*14*	*17*	..
Other urban districts*																		
Number	442	15	63	68	97	49	88	60	2	350	17	57	51	61	37	62	61	4
% of all ages ..	*100*	*3*	*14*	*16*	*22*	*11*	*20*	*14*	*0*	*100*	*5*	*16*	*15*	*17*	*11*	*18*	*17*	*1*
Rural districts*																		
Number	297	7	27	45	74	36	60	44	4	243	7	36	29	50	32	45	42	2
% of all ages ..	*100*	*2*	*9*	*15*	*26*	*12*	*20*	*15*	*1*	*100*	*3*	*15*	*12*	*20*	*13*	*19*	*17*	*1*

* Excluding Greater London.

table II shows the relative proportions of the two forms. For the country as a whole there was a small increase in 1949 in the proportion of cases described as polioencephalitis; this happened most in the county boroughs and not at all in the rural districts.

Table III shows the age-distribution of corrected notifications in the June and September quarters of 1947 and 1949 for the country as a whole, distinguishing the sexes. There was practically no difference in age-distribution between the sexes at any period. Despite the small number of cases in the June quarters, the age-distributions were similar in the two years, especially among males. There was also little difference between the two September quarters. But in both sexes and in both years there was a slight tendency between the June and September quarters for a transfer of cases from the age-group 5–9 years to a younger age.

TABLE III—CORRECTED NOTIFICATIONS OF ACUTE POLIOMYELITIS (INCLUDING ACUTE POLIOENCEPHALITIS) IN JUNE AND SEPTEMBER QUARTERS, 1947 AND 1949. PERCENTAGE DISTRIBUTION BY SEX AND AGE (INCLUDING NON-CIVILIANS), ENGLAND AND WALES

Quarter	All ages	0–	1–	3–	5–	10–	15–	25 and over	Age not stated
MALES									
June Quarter, 1947									
Number	151	8	19	24	40	21	22	17	..
% of all ages	*100*	*5*	*13*	*16*	*26*	*14*	*15*	*11*	..
September Quarter, 1947									
Number	3030	111	446	397	638	468	497	433	40
% of all ages	*100*	*4*	*15*	*13*	*21*	*15*	*17*	*14*	*1*
June Quarter, 1949									
Number	126	9	16	17	33	17	15	16	3
% of all ages	*100*	*7*	*13*	*13*	*26*	*13*	*12*	*13*	*3*
September Quarter, 1949									
Number	1476	62	257	223	311	187	232	195	9
% of all ages	*100*	*4*	*17*	*15*	*21*	*13*	*16*	*13*	*1*
FEMALES									
June Quarter, 1947									
Number	126	4	15	25	33	17	18	9	2
% of all ages	*100*	*3*	*14*	*20*	*26*	*13*	*14*	*7*	*2*
September Quarter, 1947									
Number	2357	96	338	302	435	331	401	431	23
% of all ages	*100*	*4*	*14*	*13*	*19*	*14*	*17*	*18*	*1*
June Quarter, 1949									
Number	103	3	16	14	23	13	15	19	..
% of all ages	*100*	*3*	*15*	*14*	*22*	*13*	*14*	*18*	..
September Quarter, 1949									
Number	1191	61	313	176	223	134	184	194	6
% of all ages	*100*	*5*	*26*	*15*	*19*	*11*	*15*	*16*	*1*

Table IV, which is in two parts, (*a*) 1947 and (*b*) 1949, presents the age-distribution of corrected notifications in regions and density aggregates during the September quarters only. Space does not permit a detailed discussion of the table but the data have been presented in full for the benefit of those who wish to study them. Points to which attention may be drawn are the high proportion of male cases at ages 5–9 years in 1949 in the South-West region (28%) and in rural districts (26%). Otherwise there was considerable uniformity of age-distribution over most of the country.

Table V compares deaths in the 126 Great Towns, classified by regions, during June–October, 1949. It has not been practicable to make a similar comparison for 1947 because weekly poliomyelitis deaths were not reported in that year. Death-rates were highest in the South-West region (48 per million) and in the South-East excluding Greater London (45 per million). Lowest rates were recorded in the Midland region (20 per million) and in Greater London (28 per million). Table V also gives original notifications and notification-rates (for the Great Towns only) and shows the number of deaths in each region per hundred notifications. It should be noted that the deaths and notifications here are not strictly comparable, if only because a number of deaths occurred in Great Towns (e.g., in hospitals) of cases notified in areas outside the Great Towns. The effect of this has not necessarily been the same in all regions, so these deaths/notifications ratios must be accepted with caution. Nevertheless they provide some indication of the extent to which the fatality of poliomyelitis apparently varied among the different regions. Fatality so estimated was highest (26%) in Wales, followed by the East (17%) and the South-West region (16%). It was lowest in Greater London (7%) and in the Midland region (9%). Averaged over the 126 Great Towns the ratio was 11%; but, for the reason given above, this is probably an overestimate of the true fatality-rate of notified cases. The comparable ratio for 1947 is not known.

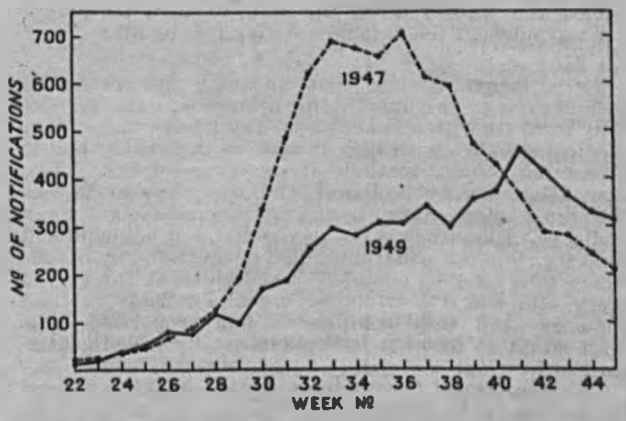
TABLE V—ACUTE POLIOMYELITIS (INCLUDING ACUTE POLIOENCEPHALITIS): ORIGINAL NOTIFICATIONS AND DEATHS; RATES PER MILLION LIVING AND DEATHS PER 100 NOTIFICATIONS, JUNE TO OCTOBER, 1949 (22-WEEK PERIOD); 126 GREAT TOWNS OF ENGLAND AND WALES BY REGIONS (EXCLUDING NON-CIVILIANS)

Great Towns in	No. of deaths	Annual rate per million living	Original notifications	Annual rate per million living	Deaths per 100 notifications
ENGLAND AND WALES	267	30	2469	281	11
South-East	107	31	1252	365	9
Greater London	77	28	1058	383	7
Remainder of S.-E.	30	45	194	289	15
North	100	33	695	228	14
Midland	32	20	373	236	9
East	9	41	52	240	17
South-West	10	48	63	305	16
Wales	9	32	34	119	26

Poliomyelitis

In the week ended Nov. 12 notifications in England and Wales were: poliomyelitis 293 (318), polioencephalitis 23 (12). Figures for the previous week are shown in parentheses. Multiple cases were reported from the following counties:

London 50 (55), Bedford 6 (2), Berkshire 7 (3), Buckingham 2 (4), Chester 16 (10), Derby 3 (2), Devon 3 (3), Dorset 7 (3),



Durham 3 (2), Essex 24 (26), Gloucester 6 (9), Hereford 4 (2), Hertford 4 (9), Huntingdon 5 (0), Kent 15 (16), Lancaster 26 (32), Leicester 12 (3), Lincs, Lindsey 5 (13), Middlesex 14 (17), Norfolk 7 (5), Northampton 4 (1), Northumberland 4 (2), Nottingham 9 (8), Oxford 2 (2), Salop 2 (0), Somerset 2 (11), Southampton 9 (13), Stafford 7 (3), Suffolk, East 2 (2), Surrey 6 (14), Sussex, East 5 (9), Sussex, West 1 (3), Warwick 7 (8), Westmorland 3 (1), Wiltshire 2 (1), Yorks, North Riding 2 (2), Yorks, West Riding 36 (50), Glamorgan 4 (7).

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Mortality from Diphtheria: The Recent Trend compared with Scarlet Fever, Whooping Cough and Measles

By W. P. D. LOGAN, B.Sc., M.D., D.P.H.
Medical Statistician, General Register Office

THE efficacy of the diphtheria immunisation campaign in bringing about a reduction in the mortality from diphtheria is fairly generally accepted, though there are some who maintain that the total decline in the mortality from diphtheria during, say, the past half-century has not been much different from the decline in respect of other diseases, such as scarlet fever, whooping cough, or measles, against which no widespread immunisation campaigns have been carried out. It may be helpful, therefore, to examine how the trend of diphtheria mortality in recent years compares with that of the three other diseases.

Method

To make the comparison as simple and as clear as possible four diagrams are presented, one for each disease, illustrating and showing the trends of mortality from 1866–70 to 1949. The continuous curve in each diagram is a trend line calculated from the quinquennial death-rates per million living at ages under 15 from 1866–70 to 1936–40 and thence extended forward to 1949. It shows for the years 1941–49 (to the right of the vertical line in each diagram) what the death-rates were likely to have been if the trend from 1866–1940 had been maintained. The circles on each diagram represent actual quinquennial rates from 1866–70 to 1896–1900, and the dots actual annual rates from 1901–1949. The diagrams show at a glance what actually did happen from 1941 onwards (dots) compared with what might reasonably have been expected to happen on the basis of past experience (continuous line).

TABLE I

Mean annual death-rates per million living at ages under 15 England and Wales, 1866–70 to 1949
Actual and Calculated Rates

	Scarlet Fever		Whooping Cough		Diphtheria		Measles	
	Actual	Calculated	Actual	Calculated	Actual	Calculated	Actual	Calculated
1866–70	2,258	2,383	1,405	1,294	871	858	1,109	871
1871–75	1,760	1,759	1,282	1,323	788	850	962	1,009
1876–80	1,575	1,295	1,349	1,318	709	830	988	1,123
1881–85	1,012	952	1,180	1,280	828	801	1,070	1,198
1886–90	572	698	1,163	1,211	781	763	1,234	1,228
1891–95	434	511	1,070	1,117	875	718	1,104	1,208
1896–1900	331	373	1,003	1,003	872	667	1,184	1,140
1901–05	319	271	874	878	653	612	955	1,033
1906–10	224	197	756	748	491	554	874	898
1911–15	161	143	633	622	434	496	1,043	750
1916–20	84	103	473	503	439	438	625	601
1921–25	79	75	448	397	302	382	420	462
1926–30	48	54	360	305	294	329	357	341
1931–35	50	39	223	228	293	279	270	242
1936–40	24	28	146	167	283	235	138	164
1941–45	10	20	140	119	153	194	75	107
1941	11	23	279	136	280	210	128	128
1942	9·3	21	94	127	192	202	53	117
1943	11	20	129	119	134	194	86	107
1944	9·5	19	121	110	92	187	28	98
1945	7·0	17	79	103	67	180	80	89
1946	8·4	16	91	95	40	173	22	82
1947	8·4	15	99	89	23	166	69	74
1948	2·5	14	80	82	14	159	33	67
1949*	1·4	13	55	76	7·1	153	30	61

* Provisional.

TABLE II

Actual death-rates in 1949 per cent. of actual rates in 1901–05 and 1936–40 and of expected rates in 1949.
(Rates per million living at ages under 15, England and Wales)

	Scarlet Fever	Whooping Cough	Measles	Diphtheria
Per cent. of actual rates in 1901–05	0·4	6·3	3·1	1·1
Per cent. of actual rates in 1936–40	5·8	38	22	2·5
Per cent. of expected rates in 1949	11	72	48	4·6

Results

The death-rates from scarlet fever since 1939 have been falling more rapidly than the calculated trend line so that the actual rates, apart from some hesitancy in 1943–44 and in 1947, have dropped further and further below their expected values (Graph I overleaf).

The whooping cough picture is quite different (Graph II), and there is no suggestion of any acceleration downwards from the expected trend. In the nine years to 1949 four of the annual rates were above and five below their expected values.

The measles diagram is different again (Graph III). Since 1939 the death-rates in each year have been below the trend line but they have not been dropping away rapidly as in the case of scarlet fever. They seem rather to have been moving parallel with the trend line but at a lower level. Annual fluctuations, however, tend to confuse the picture.

Graph IV demonstrates clearly that the mortality from diphtheria underwent an abrupt change after 1941. From that year onwards the charted rates all lie practically on a straight line directed sharply downwards from the gently curving trend line, and indicate a succession of annual death-rates that have been diminishing rapidly and steadily.

Thus diphtheria seems to have behaved quite differently from whooping cough and measles but not so very differently from scarlet fever. The decline in scarlet fever began a few years earlier, has not been so uniformly progressive, and relative to the trend line has been less in amount, but otherwise the recent mortality trends of the two diseases look rather similar.

This similarity does not necessarily mean, however, that there has been one and the same beneficent influence operating upon the two diseases to cause their death-rates to fall in so similar a fashion. Indeed, there is every reason to believe that the mechanism of reduction in the two diseases has been different. Figures for notifications (Table III) indicate that whereas the incidence of reported scarlet fever cases has declined by only 11 per cent. between 1938–40 and 1949, diphtheria notifications have declined by 91 per cent. The fall in the death-rates from scarlet fever has, therefore, been almost entirely the result of reduced fatality. The number of cases has scarcely fallen but the number of deaths among those cases has become much smaller, largely under the impact, probably, of sulphonamide and penicillin therapy. With diphtheria, on the other hand, matters have been very different, and much of the reduction in the death-rates has been the result of a

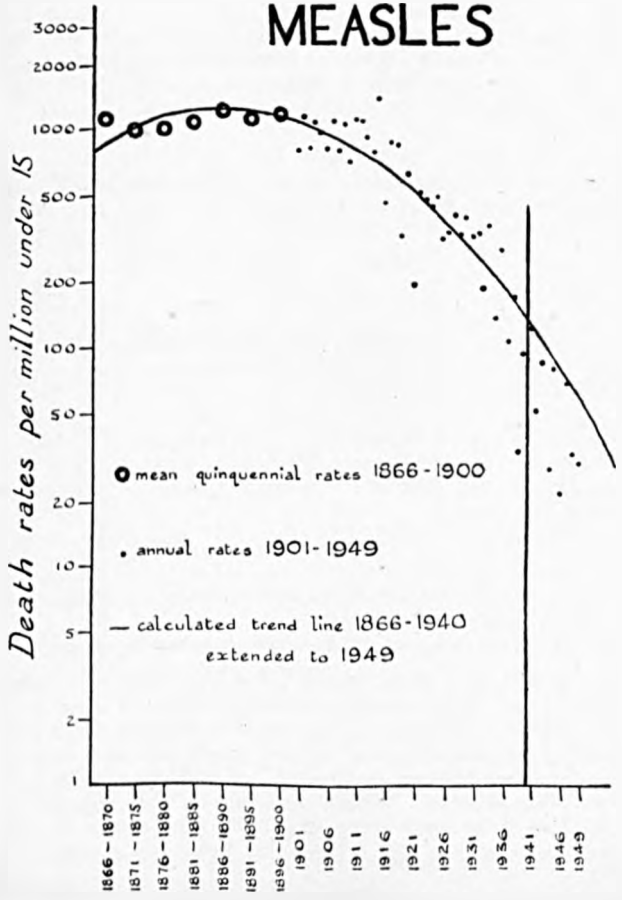
TABLE III

Number of original and corrected notifications at all ages England and Wales—1938, 1939, 1940, 1948 and 1949

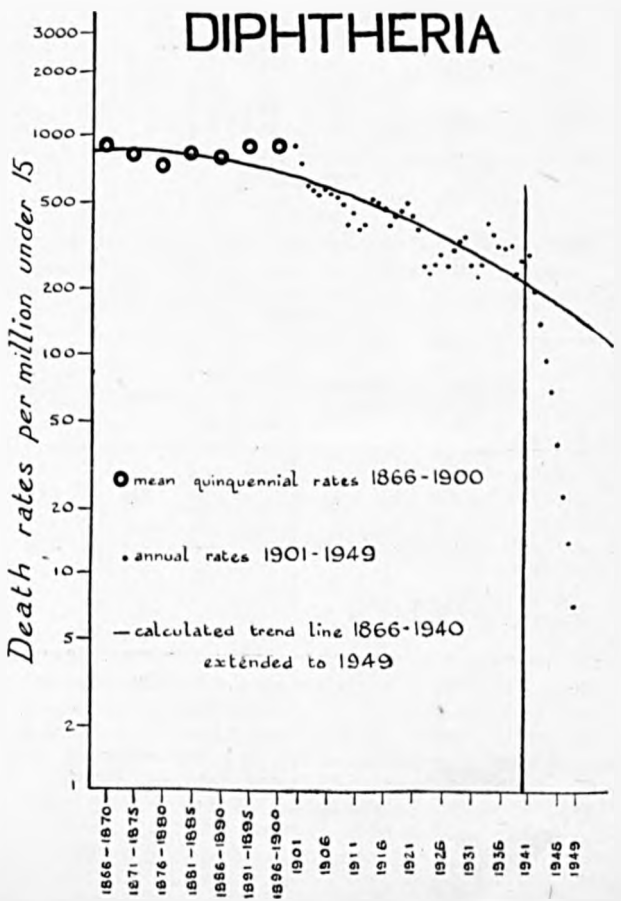
	Scarlet Fever		Diphtheria	
	Original	Corrected	Original	Corrected
1938	99,278	*	67,868‡	*
1939	78,101	*	49,426‡	*
1940	65,302	*	48,316‡	*
1948	76,377	74,831	8,035	3,575
1949†... ...	72,002	70,667	4,982	1,890
1949 per cent. of 1938–40	89%		9%	

* Not available. Full correction for diagnosis revision was not introduced until 1944.
† Provisional.
‡ Adjusted to allow for partial correction of diagnosis (see Appendix).

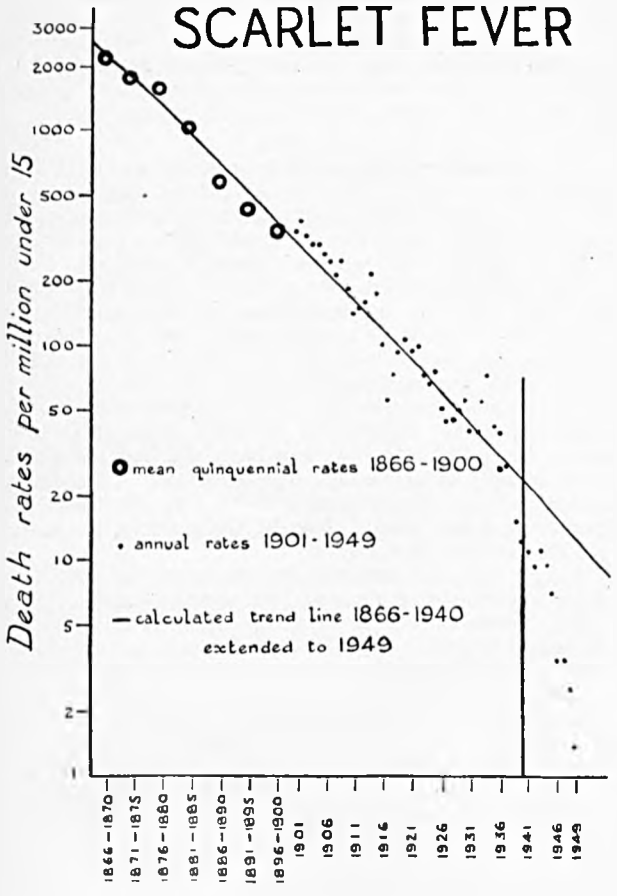
GRAPH III



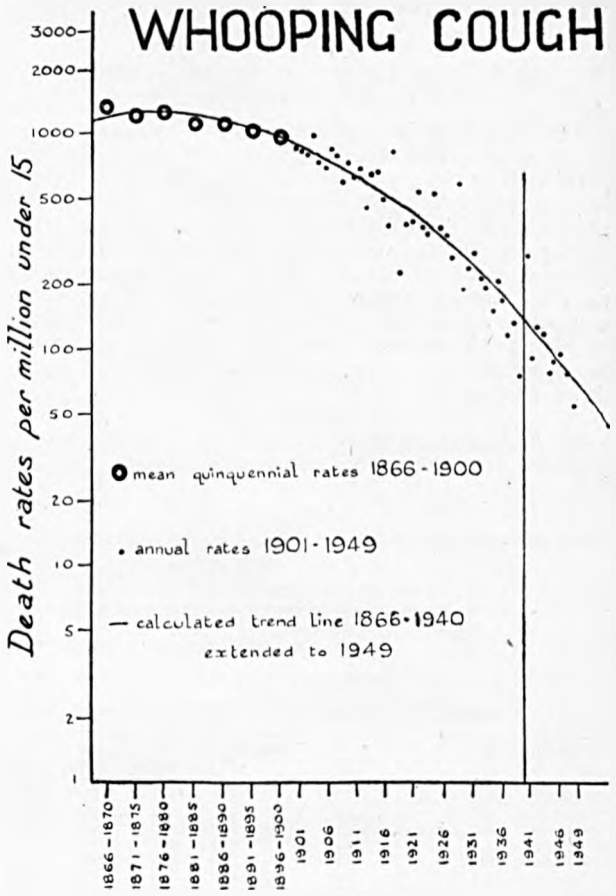
GRAPH IV



GRAPH I



GRAPH II



tremendous fall in case incidence though there has also been a considerable reduction in fatality as well; not only have there been fewer cases but the proportion of deaths occurring among the cases has also diminished.

From the statistical evidence presented in this note it is not intended to *prove* that immunisation has reduced the mortality from diphtheria but to demonstrate that following the introduction of widespread immunisation against diphtheria late in 1940, the mortality from that disease has been reduced to an extent quite different from whooping cough and measles and in a manner different from scarlet fever. On the basis of the trend from 1866 to 1940, 1,427 children under 15 might have been expected to die from diphtheria in England and Wales in 1949. The number who did die was 67.

Appendix

The trend lines for each of the four diseases were drawn from equations of the form:—

$$y = a + b_1 x + b_2 x^2$$

where y = logarithm of mean quinquennial death-rate from each disease per million living at ages under 15

and x = quinquennial periods from 1866–70 to 1936–40.

The mortality-rates up to 1948 were obtained from Table 9 of the Registrar-General's Statistical Reviews of England and Wales, Part I (Medical), 1943 and 1948, and notifications from Tables 28 and 29, 1948, slightly adjusted for years 1938–40 for the reasons given in the Statistical Review, 1940–45, Medical Text, p. 85.